Introduction

This manual has mainly introduced the items related to performance, structure, operation, maintenance, as well as service, and other aspects of M portfolio 5-10t forklift trucks, in order for operators to understand the forklift trucks, and to use and maintain the trucks correctly.

During the application of forklift trucks, user's operators and equipment management personnel involved shall carefully observe the requirements and specifications for forklift trucks in this manual, for the forklift trucks to regularly maintain a good technical condition.

Due to our continuous improvement of the forklift truck products, the items of this manual are subject to alteration and may vary slightly from the real forklift trucks without prior notice, for which your kind understanding is expected.

Note: The type code in this manual is different from the model on product data plate and certificate of conformity. The type code of this series of trucks has covered engine and its modification code.

Example:

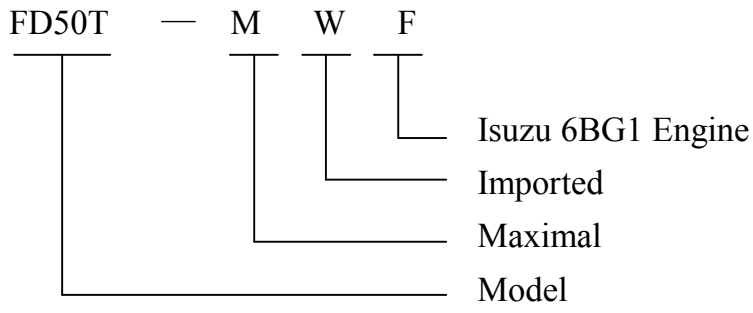


Table of Contents

I. Safety Rule for Drive and Operation of Forklift Truck

I. The drivers and management personnel of forklift truck must bear in mind “Safety First”, and conduct safety operation and standard operation according to the “Operation and Maintenance Manual” for the forklift truck.

II. Conveyance of Forklift Truck

It is required to pay attention to the following items when motor vehicle is used to load and convey the forklift truck.

1. Skid the parking brake.

2. Both the front and rear parts of mast and counterweight shall be properly fixed using steel wire. The corresponding positions of front and rear tyres shall be firmly wedged up using wedge blocks.

3. The forklift truck shall be listed according to the marked position on the “Lift Data Plate” for forklift truck at the lifting time.

III. Storage of Forklift Truck

1. Drain the fuel completely (It is not to be drained if coolant is the antirust and antifreeze fluid.)

2. Coat the surface of unpainted parts with antirust oil, and coat the lift chain with lubricating oil.

3. Drop the mast to the lowest position.

4. Skid the parking brake.

5. Wedge up the front and rear tyres properly using wedge blocks.

IV. Preparation prior to Use

1. Avoid examining fuel, oil leak, oil level, and examining electrical instrument in a place with an open fire, and avoid adding fuel during operation.

2. Examine the air pressure of tyres.

3. It is required to place the handle for forward/backward gear at the middle position (zero gear position).

4. Don’t smoke when fuel system is working and when battery is being examined.

5. Examine the status of respective handles and pedals.

6. Get properly prepared for startup.

7. Loosen the parking brake.

8. Perform the test actions such as rise and fall of mast, forward and backward tip, steering, and brake.

V. Operation of Forklift Truck

1. Only the drivers who have been trained and hold driving license are allowed to drive the truck.

2. The operators shall wear shoes, helmet, clothes, and gloves that can be used for safety protection.

3. Examine respective controls and warning devices before truck is driven, and the truck shall be operated after it has been repaired in the case when any damage or defect is found.

4. During conveyance, the load shall not exceed the specified value, the fork must be completely inserted into the underside of cargo, and the cargo must be uniformly placed on the fork. It is not allowed to pick up cargo using a single fork tip.

5. Smoothly perform start, steering, running, brake, and, and slow down at turning, on wet or smooth pavements.

6. It is required to place cargo as low as possible, and to keep the mast tilt backwards, when cargo is loaded for driving.

7. It is required to be careful during driving on a ramp. It is required to drive forward during upgrade and drive reversely during downgrade, when the truck is driven on a ramp larger than 1/10. Turning shall be avoided by all means, and please never perform loading-unloading operation when forklift truck is running downgrade.

8. It is required to pay attention to passengers, obstacles, and low-lying pavements, and pay attention to the clearance above the forklift truck, during driving.

9. It is not allowed for anyone to stand on fork and it is not allowed for anyone to be carried on truck.

10. It is not allowed for anyone to stand under the fork, or to walk under the fork.

11. It is not allowed to control the truck and attachments at any position other than the driver seat.

12. It is required to pay attention to the fall of cargo from above, for any high lift forklift trucks with a lifting height larger than 3m, and protective measures must be taken, when necessary.

13. Try as much as possible to tip backward the mast for high-lift forklift trucks during work, and it is required to perform front or back tip within the minimum range during loading-unloading operation.

14. It is required to take a doubled care, and to drive slowly, during running on dock or on temporary planks.

15. Driver shall not stay on the truck, when fuel is added, and the engine shall be turned off. Ignition is to be avoided when battery or level of oil tank is examined.

16. The forklift trucks with attachments shall be operated as loaded forklift trucks during unloaded operation.

17. Don't convey unfixed or loosely stacked cargo, and take care when cargo of relatively large size is conveyed.

18. Drop the fork onto the ground, put the handle for gear position to neutral gear, and turn off the engine or disconnect the power supply when driver leaves the truck. Pull the parking brake device properly when truck is parked on a ramp, while wedge blocks must be used to fill up the wheels when the truck is to be parked there for a long time.

19. It is not allowed to open radiator cover carelessly, under the condition when engine is very hot.

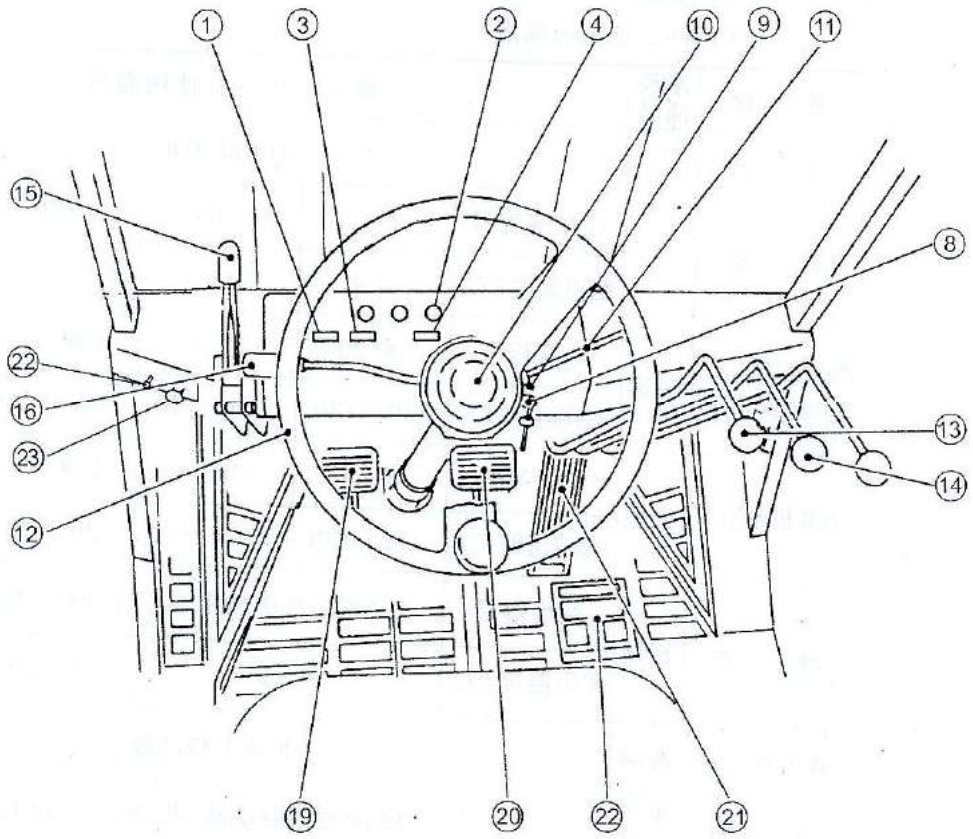
20. The pressures of multi-way valve and safety valve have been properly adjusted before delivery of forklift truck from factory, and users shall not adjust them at discretion during use, to avoid damage of entire hydraulic system and hydraulic components due to excessively high adjustment.

21. The value of air pressure specified on the label plate of "Tyre Air Pressure" shall be followed for tyre air charge.

22. The maximum noise outside the forklift truck is not to be larger than 89dB (A), and JB/T3300 shall be followed as test method.

23. Get familiar with and pay attention to the functions of various data plates on the forklift truck.

VI. Schematic Drawing of Instruments and Control Layout for Forklift Truck



1. Fuel Gage
2. Indicator Light
3. Water Temperature Gauge
4. Hour Meter
8. Ignition Switch
9. Light Switch
10. Horn Pushbutton
11. Steering Light Switch
12. Steering Wheel
13. Lift Handle
14. Tilt Handle
15. Parking Brake Handle
16. Front-Rear-Gear Handle
19. Inching Pedal
20. Brake Pedal
21. Throttle Accelerator Pedal
22. Engine Hood Stay Cable
23. Engine Stop Stay Cable

VII. Routine Maintenance of Forklift Truck

1. Key Points for Startup

1) Oil quantity and oil level of hydraulic oil shall be at the middle position of scale on oil level indicator.

2) Examine whether or not leak or damage exists with pipe, joint, pump, and valve.

3) Examine wheel brake.

a) The idle stroke of brake pedal shall be 40mm.

b) The clearance between front bottom plate and pedal shall be larger than 20mm.

4) Examine the hand brake function: When hand brake handle is thoroughly pulled, it shall be able to be skidded on a 20% ramp (no load).

5) Instruments and Illumination Light Fittings, etc: Examine whether or not the respective parts including instruments, illumination, connection joints, switches, and electrical circuit are working normally.

2. Oils, Greases, and Anti-freeze Fluids Used for Forklift Truck:

<table>
<tr><td>Name</td><td>Original Oil Product</td><td colspan="5">Brand, Code, and Temperature of Use</td></tr>
<tr><td>Gasoline</td><td></td><td colspan="5">93# or 97#</td></tr>
<tr><td rowspan="2">Diesel Oil</td><td rowspan="2"></td><td>Brand of Light Diesel Oil</td><td>0#</td><td>-10#</td><td>-20#</td><td>-35#</td></tr>
<tr><td>Application Temperature (℃)</td><td>≥4</td><td>≥-5</td><td>≥-5～-14</td><td>≥-14～-29</td></tr>
<tr><td rowspan="2">Gasoline Engine Oil (SF) Electronic Injection Type (SG)</td><td rowspan="2">Great Wall</td><td>Viscosity Grade</td><td>5W/30</td><td>10W/40</td><td>10W/30</td><td>15W/40</td></tr>
<tr><td>Application Temperature(℃)</td><td>-30～+40</td><td>-25～+40</td><td>-25～+30</td><td>-25～+40</td></tr>
<tr><td rowspan="2">Diesel Engine Oil (CD)</td><td rowspan="2">Great Wall</td><td>Viscosity Grade</td><td>5W/30</td><td>10W/30</td><td>15W/40</td><td>20W/50</td></tr>
<tr><td>Application Temperature(℃)</td><td>-30～+30</td><td>-25～+30</td><td>-20～+40</td><td>-15～+50</td></tr>
<tr><td rowspan="2">Hydraulic Oil</td><td rowspan="2">Kunlun</td><td>Viscosity Grade</td><td colspan="2">L-HM32 Antiwear Hydraulic Oil</td><td colspan="2">L-HV32 Low Temperature Antiwear Hydraulic oil</td></tr>
<tr><td>Application Temperature(℃)</td><td colspan="2">＞-19</td><td colspan="2">＞-33(in Open Air in Cold Regions)</td></tr>
<tr><td>Torque</td><td>HAIPAI</td><td colspan="5">6# Torque converter oil</td></tr>
</table>

converter oil						
Brake Fluid	Chongqing Yiping	4604 Synthetic Brake Fluid GB12981HZY4				
Lubricating Grease	Great Wall	3# General Lithium Base Lubricating Grease(-20℃～+120℃)				
Heavy-duty Truck Gear Oil	HAIPAI	Viscosity Grade	85W/90GL-5		80W/90GL-5	
		Application Temperature(℃)	-15～+49		-25～+49	
Anti-freeze Fluid	Jinbai	Code	FD-1	FD-2	FD-2A	FD-3
		Application Temperature(℃)	≥-25	≥-35	≥-45	≥-50

3. Notices for Operation of Cooling System

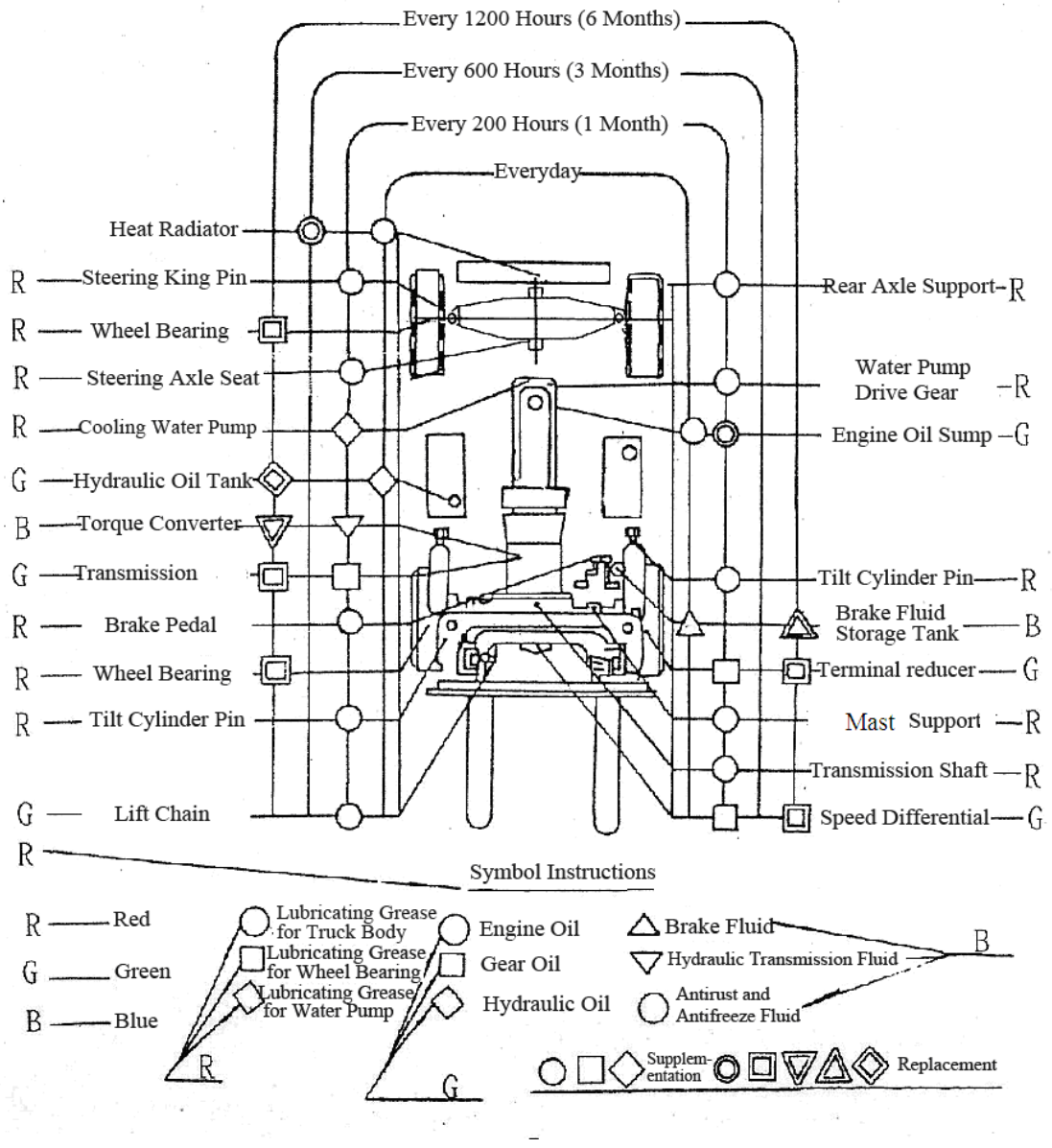
1) When forklift truck is being operated, in the case when radiator is overheated or temperature of coolant is excessively high, don't open the radiator cover immediately. Examine the liquid level, in order to find the overheating cause. When cover has to be opened, it is required to slow down the engine to a medium speed. Turn the radiator cover slowly and loosen off the cover after waiting for a while, to avoid scald of operator by splash of coolant. Make sure to screw the radiator cover properly in place, when it is tightened up, and otherwise it is difficult to build up a specified pressure system.

2) There is a feeding tank on the left side of engine, with the marks of FULL and LOW labeled in the upper and lower parts of the tank wall, and the level of anti-freeze fluid shall be between these two countermarks during use. Antirust and anti-freeze fluid of the same model shall be supplied after anti-freeze fluid is leaked out or evaporated. Anti-freezing fluid is generally used both in winter and summer, not changed for four seasons. It shall be drained out for filtration and purification treatment after use for one year in general, to be then further used.

3)According to different work conditions, the smudge on the outer surface of radiator shall be periodically cleaned and removed, either to be soak cleaned using detergent, or to be flushed using compressed air or high-pressure water (pressure not larger than 4kg/cm).

4. Drawing of Lubricating System

Drawing for Lubricating System

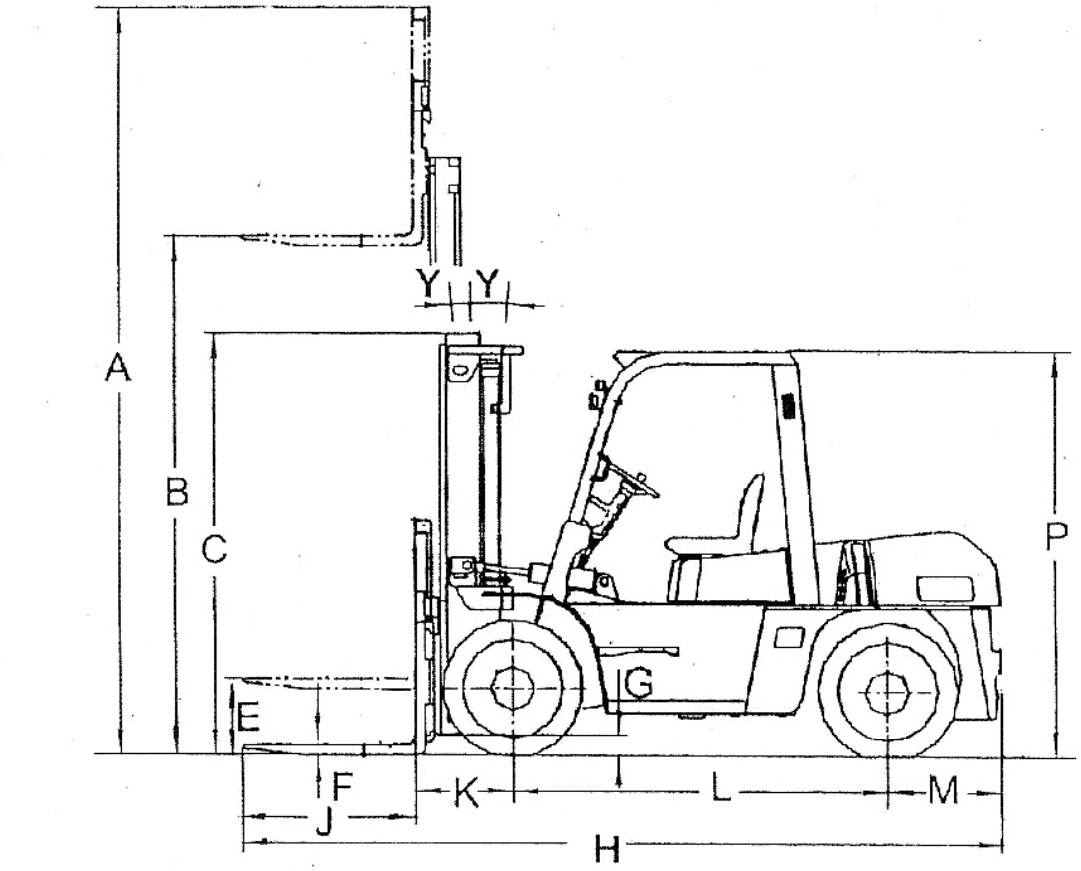


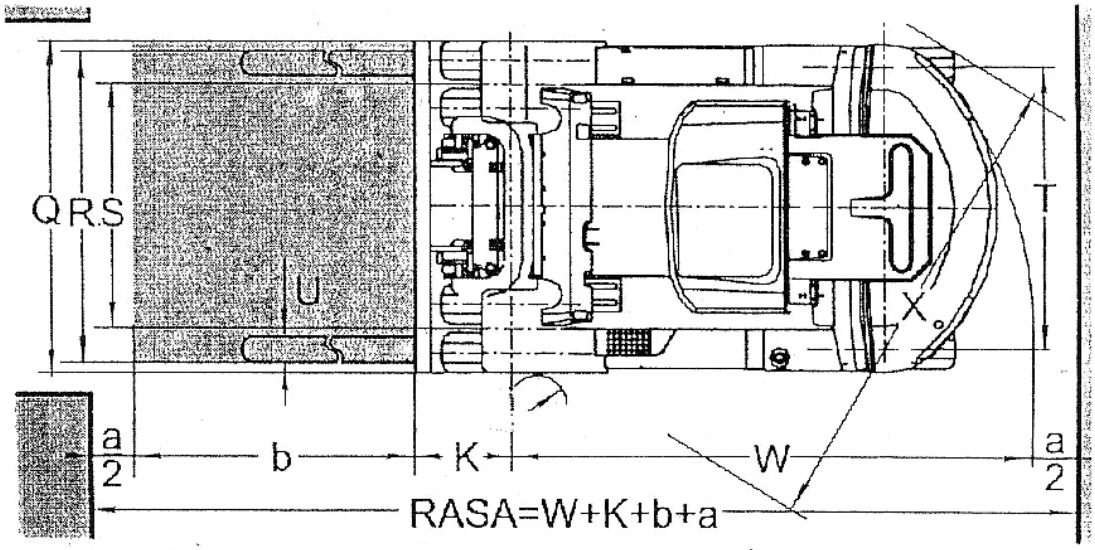
II. Main Technical Parameters for Forklift Truck

Parameter \ Forklift Truck Lifting Capacity			5t	6t	7t	8t	10t
Rated Load-lifting Capacity		kg	5000	6000	7000	8000	10000
Load Center Distance		mm	600				
Max Lifting Height (Standard) B			3000				
Free Lifting Height (Standard) E			195	200	205	200	210
Mast Tip Angle Y/Y		(°)/(°)	6/12				
Min Turning Radius W		mm	3250	3300	3370	3700	3900
Min Right Angle Aisle Width X			2960	3000	3040	3310	3540
Min Off-ground Clearance G			200			250	245
Wheelbase L			2250			2500	2800
Tread Front/Rear S/T			1470/1700			1600/1700	
Clearance Front/Rear K/M			590/600	590/675	590/740	700/740	718/740
Whole Length H			4660	4735	4800	5160	5480
Entire Length Q			1995			2165	2245
Whole Height	Mast C		2500		2625	2700	2850
	Overhead Guard P	mm	2450			2585	
Height at Rise of Fork (with Cargo Stop Frame) A		mm	4420				4330
Fork	Length J		1220				
	Width×Thickness F		150×55	150×60	150×65	170×70	175×80
Fork Adjusting Range (Outer Side of Fork) R			300-1700			340-1944	410-2140
Forklift Truck Dead Weight		kg	8080	8740	9450	11660	12610
Axle Load	Full Load Front/Rear		11660/1320	13050/1590	14570/1780	17000/1950	20380/2130
	No-Load Front/Rear		4010/3970	3880/4760	3860/5490	4840/6120	5700/6810
Tyre	Front 4		8.25-15-14PR			9.00-20-14PR	
	Rear 2		8.25-15-14PR			9.00-20-14PR	
Batte4ry Voltage/Capacity		V/Ah	24/80				

Parameter \ Vehicle Type			FD50-70T MWF		FD50-70T MGH		FD50-60T MWJ		FD50-70T MWH		
Engine	Model		Isuzu (Diesel) A-6BG1QC		Chaochai 6102BG		Mitsubishi (Diesel) S6S-T		Perkins 1104D-44TA		
	Number of Cylinders –Diameter of Cylinder × Stroke	mm	6-105×125		6-102×118		6-94×120		4-105×127		
	Rated Power/Rotating Speed	Kw/rpm	82.3/2000		81/2500		67.6/2300		83/2300		
	Max Torque/Rotating Speed	Nm/rpm	416/1400-1600		353/1650		293/1700		418/1400		
	Min Fuel Consumption Rate	g/kwh	233		231		265		245		
Number of Transmission Shift Gears Front/Rear			2/2 Power Gear Shift								
Wheel Brake Mode			Power Brake		Vacuum Power or Power Brake		Power Brake		Power Brake		
Lifting Speed Full Load/No-Load		Mm/s	460/500	380/420	400/600	400/600	390/500		460/500	380/420	
Max Running Speed Full Load/No Load		Km/h	26/28		26/28		26/28		26/28		
Max Gradeability Full Load/No Load		%	35/19	32/19	30/19	20/15		26/23	22/20	35/19	32/19	32/119
Max Traction Capacity Full Load		KN	54		53	53	52	45		54	

Parameter \ Vehicle Type			FD80T	FD100T	FD80T	FD100T
Engine	Model		Isuzu A-6BG1QC (Diesel)		Chaochai 6102BG	
	Number of Cylinders – Diameter of Cylinder x Stroke	mm	6-105×125		6-102×118	
	Rated Power/Rotating Speed	Kw/rpm	82.3/2000		81/2500	
	Max Torque/Rotating Speed	Nm/rpm	416/1400-1600		353/1650	
	Min Fuel Consumption Rate	g/kwh	233		231	
Number of Transmission Shift Gears Front/Rear			2/2 Power Gear Shift			
Wheel Brake Mode			Power Brake – Pedal Type			
Lifting Speed Full Load/No-Load		mm/s	380/410	310/350	390/480	310/390
Max Running Speed Full Load/No-Load		km/h	26/30			
Max Gradeability Full Load/No-Load		%	21/21		21/21	20/15
Max Traction Capacity Full Load		KN	63.2	58	51	57





RASA: Width for Right Angle Stacking Aisle a: Clearance b: Load Length

III. Introduction for Main Parts of Forklift Truck

Refer to the following table for main parts of forklift truck.

S/N	Name	Item
1	Air Filter and Installation	Including air filter, air filter support plate, air inlet pipe, and air outlet pipe
2	Battery and Installation	Including battery, cross beam, and support bar
3	Radiator and Installation	Including radiator and standby tank, water supply and drain pipes, rubber gasket, and bolts for radiator
4	Fuel Device and Installation	Including cover plate assembly, cover plate gasket, air plug, oil quantity sensor, oil tank cover, oil-water separator, diesel oil filter, and oil delivery hose
5	Muffler and Installation	Including muffler, front vent pipe, rubber gasket, connecting pipe, vent pipe, and U-bolt for block plate
6	Electrical System	Mainly including light fittings, instruments, wire harnesses, and electrical components
7	Drive Axle and Installation	Mainly including axle housing, transmission, speed differential, wheel-sided reducer, half shaft, and brake
8	Front Wheel Assembly	Including tyre, front wheel rim assembly, and air valve bracket
9	Rear Wheel Assembly	Including tyre, and rear-wheel rim assembly
10	Engine and Transmission Installation	Including drive transmission, engine, transmission bracket, and transmission support
11	Transmission Control	Including bracket for control rod, pin shaft, rocking arm, and connecting rod
12	Steering Device and Installation	Including steering column, universal joint, connecting shaft, steering wheel, and handle
13	Steering Axle and Installation	Including steering axle, and steering cylinder

S/N	Name	Item
14	Torque Converter Oil Cooling System	Including articulating bolts, oil filter, oil pipe, and bracket for oil filter
15	Overhead Guard and Installation	Including overhead guard, handle, light bracket, and air intake window
16	Throttle Control	Including pedal, connecting shaft, bracket, and stay wire
17	Hand Brake Control	Including hand brake assembly
18	Brake and Inching Control	Mainly including brake and inching control, oil pipe, joint, energy accumulator (or vacuum tank and vacuum booster), brake valve, and safety valve
19	Truck Frame	Including front plate, left/right truck frames, rear truck frame, transmission bracket, bracket for tilt cylinder, engine bracket, and battery cover plate
20	Counterweight and Installation	Including counterweight, traction bolt, and netting guard
21	Instrument Bracket and Hook Installation	Including instrument bracket, internal combustion engine hood, floor, articulation, cross beam, radiator cover plate, and air spring
22	Seat and Installation	Including seats, and rubber gaskets for seats
23	Multi-way Reversing Valve Control	Including control rod, bent plate, connecting shaft, and pull rod
24	Working Oil Tank and Installation	Including oil suction pipe assembly, edge filter, and breathing apparatus
25	Hydraulic System	Mainly including gear pump, multi-way valve, hydraulic steering unit, HP oil pipe, and joint
26	Working Device	Mainly including mast, fork, fork carriage, cargo stop frame, lift cylinder, tilt cylinder, lift chain, mast sprocket, and roller, etc

IV. Structure, Principle, Adjustment, and Maintenance of Forklift Truck

1. Power System

1.1 Overview

Power system mainly includes engine, fuel system, cooling system, and exhaust system. Engine is installed on truck frame through rubber pads, to reduce vibration. Engine, torque converter, transmission, transmission shaft, and drive axle are formed into a unit. Refer to Fig 1-1.

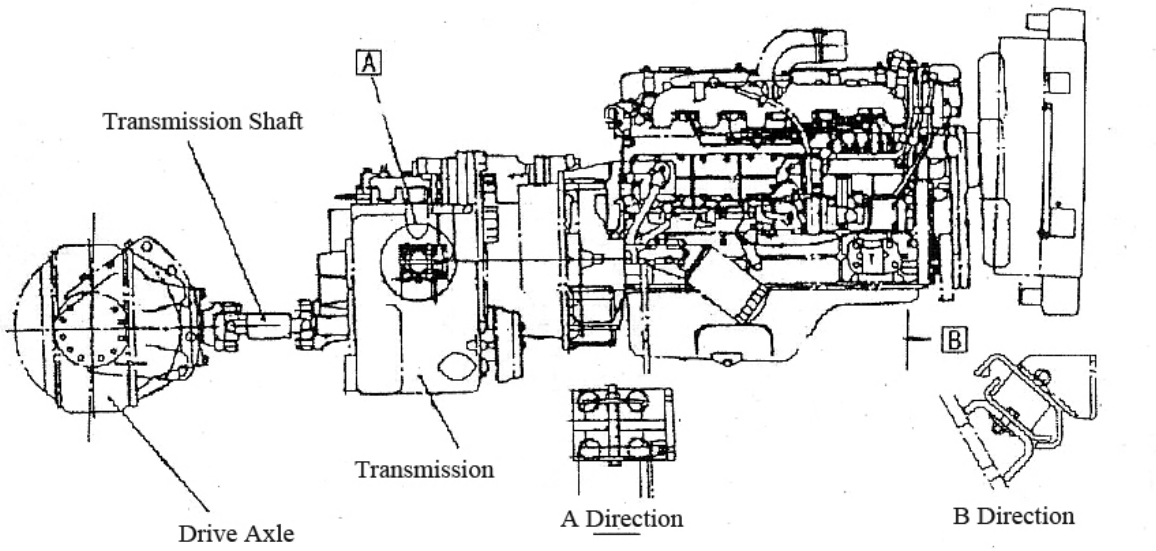


Fig 1-1 Drawing for Installation of Engine

1.2 Engine Configuration

Engines for 5-7t forklift trucks mainly include imported diesel engines such as Isuzu 6BG1, Mitsubishi S6S-T, and Perkins, and homemade diesel engines such as Chaoyang 6102BG-38. Engines for 8-10t forklift trucks include imported diesel engine Isuzu 6BG1 and homemade diesel engine Chaoyang 6102BG. The imported Isuzu 6BG1-model diesel engine is mainly described here, and the others will not be described here as user may refer to the attached operation manual for engines.

Refer to Fig 1-2 for the outside structural drawing for 6BG1, and refer to the attached Table 1 for its main performance parameters for structure and configuration.

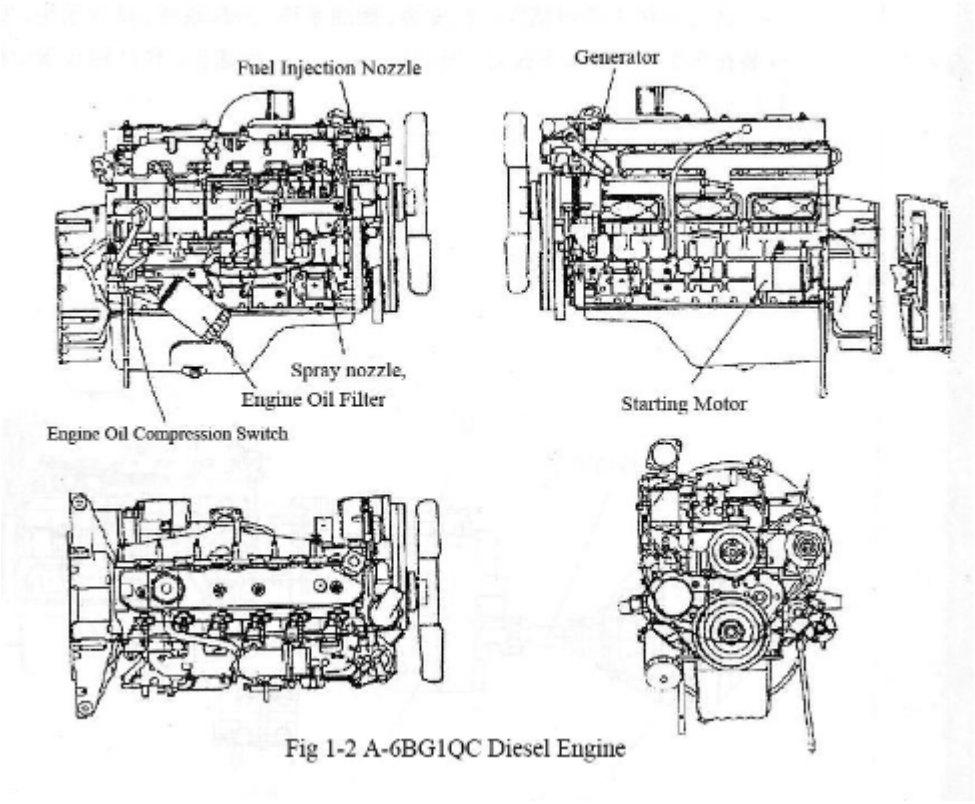


Fig 1-2 A-6BG1QC Diesel Engine

Name	A-6BG1QC
Type	4-stroke, Water-cooling, Straight-line, and top Diesel Engine
Numberof Cylinders – Cylinder Diameter × Stroke	6-105 ㎜×125 ㎜
Total Displacement (I)	6.494
Compression Ratio	17
Performance	
Rated Speed(rpm)	2000
Rated Power(kw)	82.3
Max Torque(N-m/rpm)	416/1400-1600
Fuel Consumption for Total Load (g/kwh)	233
Idle Speed(rpm)	700
Weight(㎏)	450
Dimension(㎜)	1129.5×672.0×860.0
Ignition Sequence	1-5-3-6-2-4
Rotating Direction	Looking from the end of fan in clockwise direction
Valve Gear	Top Mounted
Fuel Device	
Injection Pump	Boshing Type
Plunger Diameter x Stroke	9.5 ㎜×8 ㎜
Injection Nozzle	Multi-porous Type
Oil Feed Pump	Plunger Type
Fuel Filter	Paper Core of Filter Type
Speed Regulator	
Mode of Speed Control	Centrifugal, and Full Speed Control
Lubrication Mode	Forced Circulation Type
Lubricating Device	
Pump Type	Gear Type
Drive Type	Camshaft Drive
Oil Pressure Adjusting Device	Piston and Spring Type
Oil Pressure Indicating Device	Switch Type(0.3 kg/cm^2)
Filter Mode	Full Flow and Filter Paper Type
Cooler	Embedded Water Cooling Type
Cooling Device	
Cooling Mode	Water Cooling
Cooling Fan	Exhaust Type, 7 Fan Blades, and Outer Diameter 550mm
Drive Mode	Belt Drive

Table 1 Continued

Pump Type	Vortex Type
Drive Mode	Belt Drive
Water Temperature Adjusting Device	
Mode	Wax Pellet Type
Thermostat Opening Temperature	82℃
Thermostat Full Opening Temperature	95℃
Starting Motor	
Mode	Magnetic Engagement Type
Voltage	24V
Rated Power	4.5KW
Flameout Device	Disconnecting Fuel Passage
Preheating Device	Available
Charging Generator	
Mode	AC Generation, and Diode Rectification
Voltage	24V
Output	25A
Drive Mode	Belt Drive
Charging Automatic Regulator	IC Type (Embedded in Generator
Referential Parameters	
Oil Quantity in Oil Pan	Max: 13L Min: 10L
Cooling Water Quantity	12L
Valve Clearance	
Suction Valve	0.4 ㎜(in Cold Status)
Exhaust Valve	0.4 ㎜(in Cold Status)
Valve On/Off Time	
Suction Valve (Open)	BTDC 19°
(Close)	ABDC 47°
Exhaust Valve (Open)	BBDC 57°
(Close)	ATDC 15°
Injection Period	14° BTDC 14°
Injection Starting Pressure	185 kg/cm^2
Compression Pressure	31 kg/cm^2(200rpm)

1.3 Fuel System

Fuel system consists of fuel tank, filter, and fuel sensor device.

1.3.1 Fuel Tank

Fuel tank is a welded structure, connected with truck frame into a whole, mounted on the left side of the truck frame, with fuel tank cover plate on top, and fuel sensor mounted on the plate. Refer to Fig 1-3.

1.3.2 Fuel Sensor Device

The function of fuel sensor device is to transform the oil quantity stored in fuel tank into current through up and down movement of float, to be ultimately responded to the fuel gage on instrument panel, to allow people to visually understand the fuel quantity inside the fuel tank. Refer to Fig 1-4.

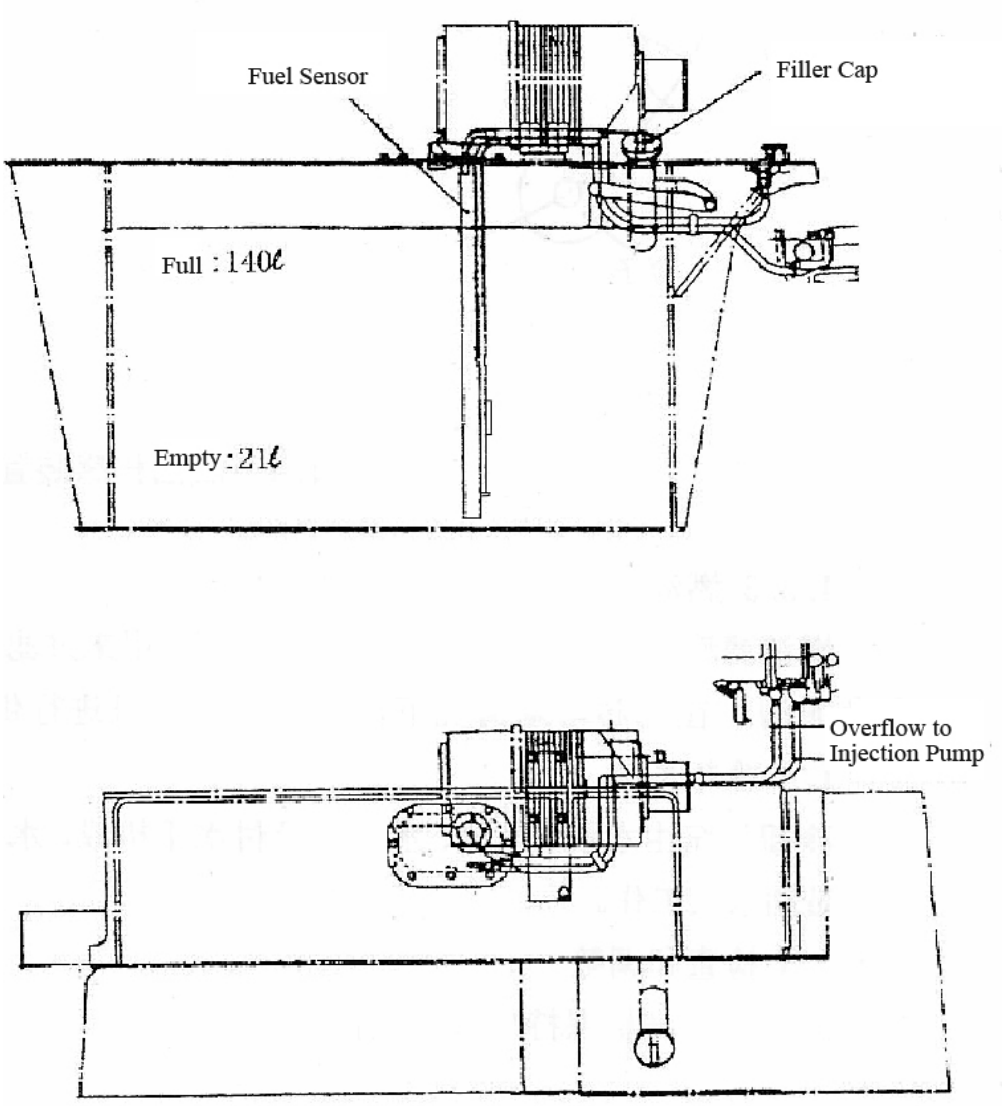


Fig 1-3 Fuel Tank

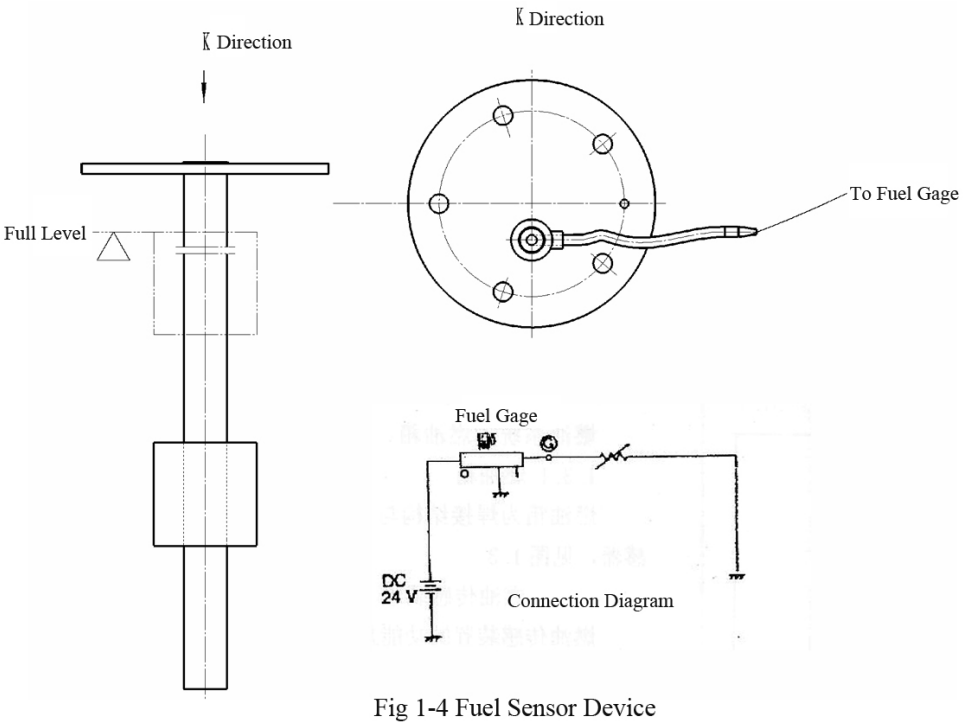


Fig 1-4 Fuel Sensor Device

1.3.3 Fuel Filter

Fuel filter is mounted on the oil inlet manifold of engine, used to filter fuel to be supplied to engine. Bypass valve is also mounted inside the filter, able to supply fuel to engine as well, under the condition when core of filter is blocked.

1.4 Cooling System

Cooling system is composed of water pump, fan, radiator, and assistant radiator. Water pump is installed on engine, and the crankshaft actuates the work of water pump through V-shaped rubber belt.

1.5 Examination and Adjustment

In order for engine to maintain a good work status, it is required to carry out regular examinations and adjustment to engine. The key points are given as follows:

1.5.1 Refer to Fig 1-5 for air filter.

(1)Take out the core of filter.

(2)Examine the dust and damage status of core of filter. Firstly use low-pressure air to blow from the inner side to the outer side, for cleaning, and the core of filter shall be replaced, if it is severely block and cannot be cleaned or it has been damaged.

(3)Clean the dust inside the cover.

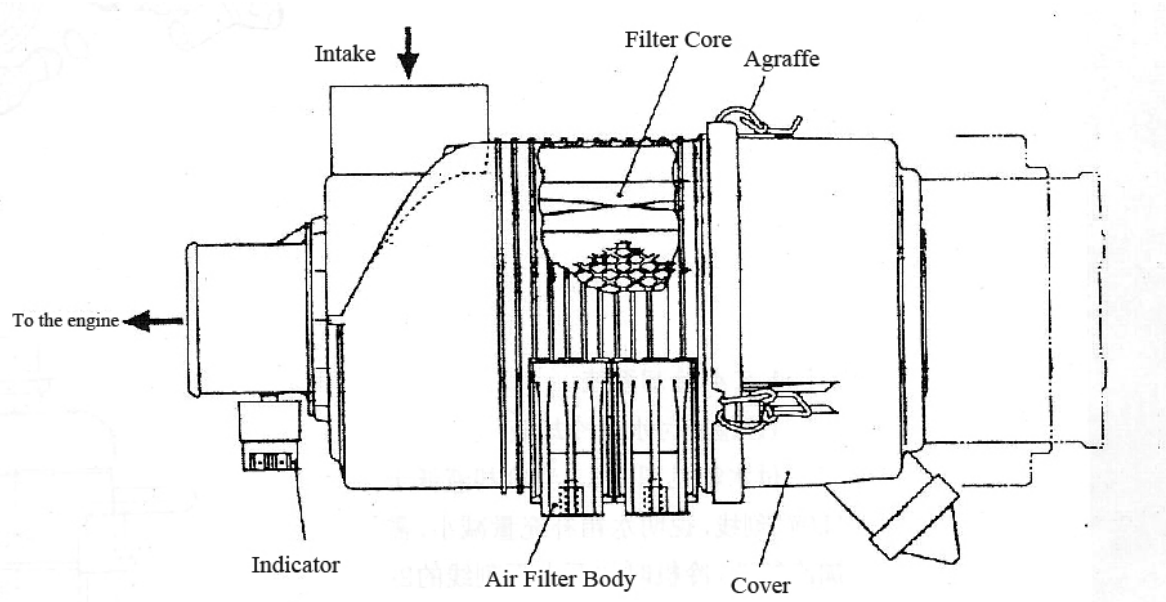


Fig 1-5 Air Filter

1.5.2 Refer to Fig 1-6 for fuel filter.

(1)Demount the fuel filter using special wrench, and it shall be replaced, if damaged or blocked.

(2)Add several drips of fuel around the seal ring along the new fuel filter and then mount it on. Further screw it in for 2/3 circles, after seal ring has touched the main body of fuel filter.

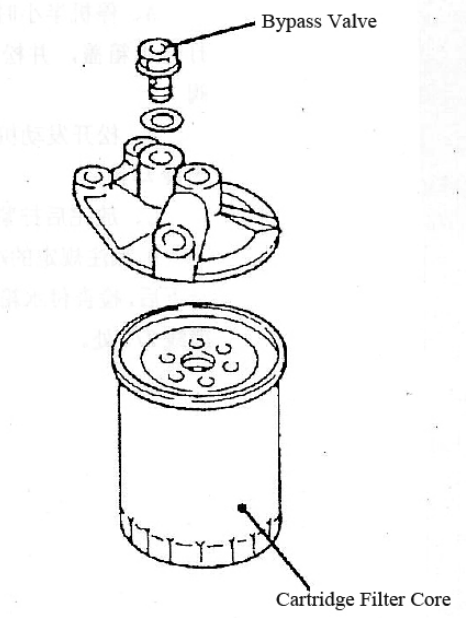


Fig 1-6

1.5.3 Refer to Fig 1-7 for engine oil filter.

(1)Detach the fuel filter using special wrench and replace it.

(2)Fill several drips of lubricating oil around the seal ring along the new engine oil filter and then mount it on. Further screw it in for 2/3 circles after the seal ring has touched the main body of the filter.

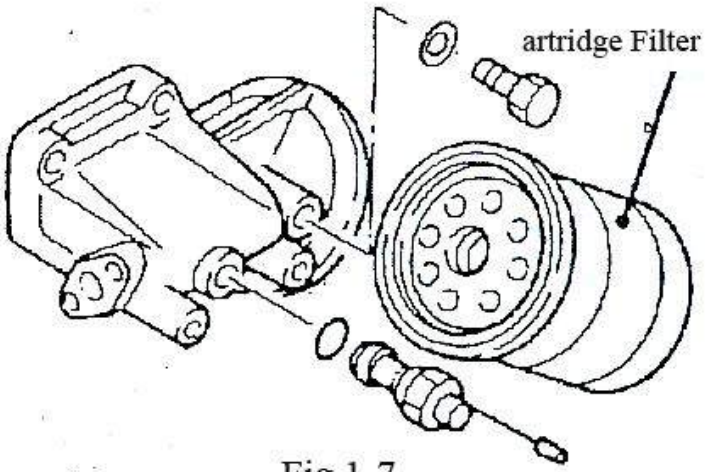


Fig 1-7

1.5.4 Cooling System

(1)Examine the coolant in the assistant radiator.

Refer to Fig 1-8 for assistant radiator, and it indicates that the supply of radiator is reduced and it is required to add coolant, when the level of coolant is lower than the scale line of "LOW, and it shall be added up to the place of 2/3 scale between the upper and lower countermarks.

(2)Replace the coolant.

A. Open the radiator cover, after shutdown for more than half an hour and until it has been cooled down, and loosen the water drain valve on the underside of radiator.

B. Loosen the water drain valve of engine, and drain the coolant completely.

C. Tighten up the abovementioned two water drain valves after coolant is completely drained.

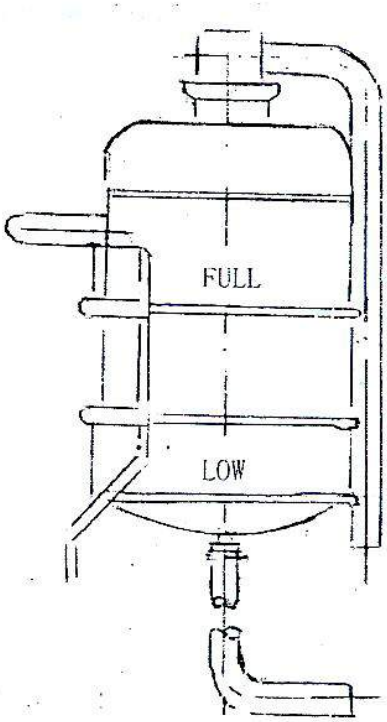


Fig 1-8

D. Add the specified coolant, and examine that the liquid level of assistant radiator shall be in the place 2/3 that of the upper and lower scale lines, after idle-speed operation for a while.

(3)Adjust the fan belt.

The fan belt shall be tightened, if it gets loose. Refer to Fig 1-9.

Procedure: Firstly loosen the fixed bolts B and C for generator, and move the generator outwards. Press the belt in the place of A with finger using a 10kg force, and its deflection is at about 10mm. Then tighten the bolts B and C in order.

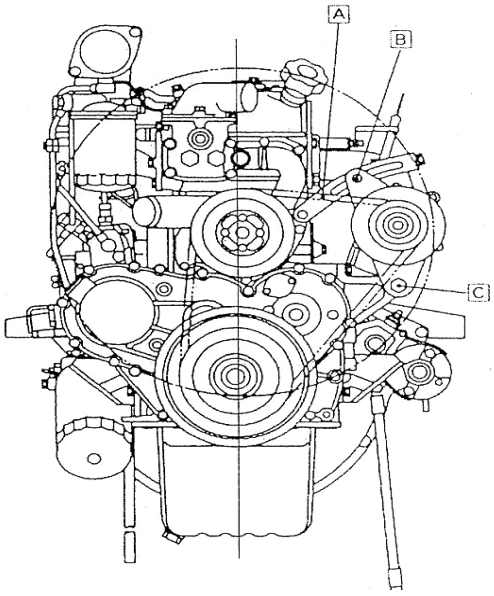


Fig 1-9

1.5.5 Fastening of Bolts for Engine Cylinder Head

(1)Tighten the bolts for cylinder head one by one at a 68Nm torque, following the sequence as indicated in Fig 1-10.

(2)Further increase the tightening torque to 93Nm, and tighten respective bolts one by one.

(3)Then turn respective bolts by 90° and screw them down.

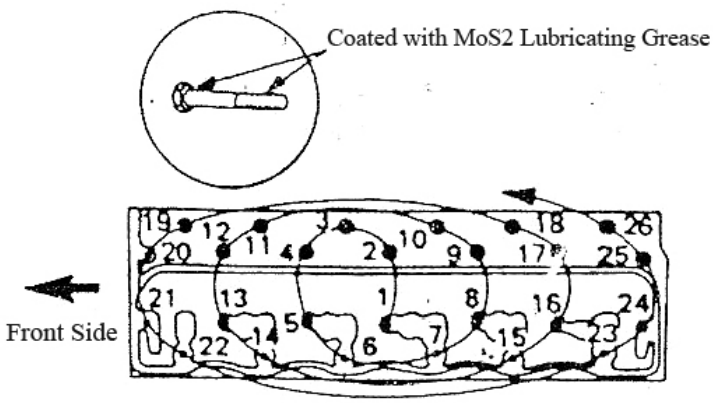


Fig 1-10

1.5.6 Adjustment of Valve Clearance

(1)Turn the crankshaft in the clockwise direction, for the "TC" mark of belt pulley shock absorber and the pointer to be superposed with each other.

(2)Open the inspection cover, and confirm the positions of bottom plate mark and the pointer.

If the positions of bottom plate mark and the pointer are consistent, it indicates upper dead center of compression stroke for the 1st cylinder. Adjust the valve clearance of "△" countermark, and adjust the valve clearance of "※" countermark as well.

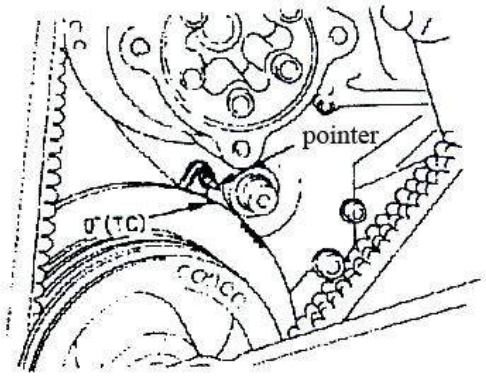


Fig 1-11

Valve Clearance Value: 0.4mm (the same value for both suction and exhaust, under the cold status)

Refer to Figs 1-11, 1-12, and 1-13 for details.

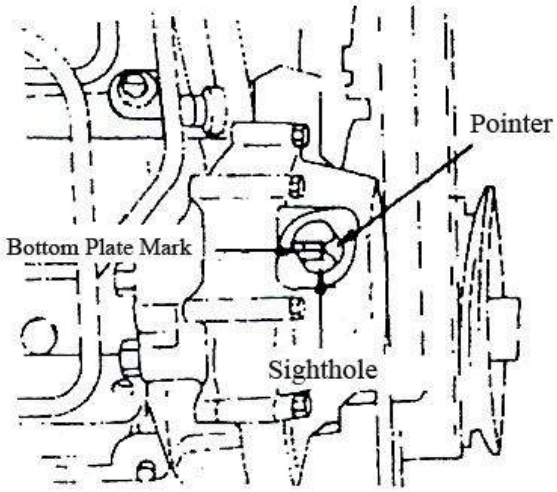


Fig 1-12

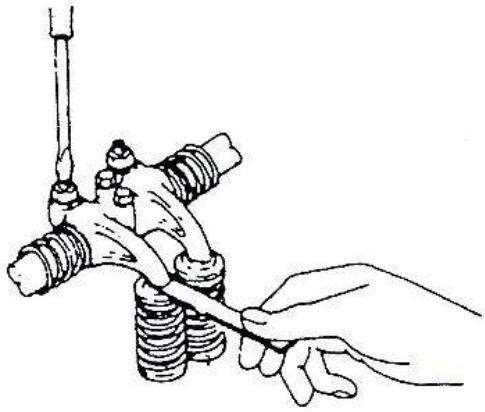


Fig 1-13

Refer to Table 1-2 for specific adjustment.

Cylinder Sequence Number	1		2		3		4		5		6	
Valve Sequence Number I: Suction Valve E: Exhaust Valve	I	E	I	E	I	E	I	E	I	E	I	E
Upper Center for 1st Cylinder Compression Stroke	△	△	△			△	△			△		△
Upper Center for 6th Cylinder Compression Stroke				※	※			※	※		※	

1.5.7 Confirmation of Ignition Time for Fuel Injection

(1)Firstly confirm whether or not the "Assembly Countermark" in the place of flange for the injection pump is consistent. Refer to Fig 1-14.

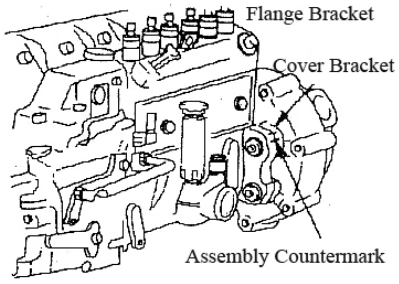


Fig 1-14

(2)Put the 1st cylinder at the position of upper dead center for compression stroke, and turn the crankshaft from this position in clockwise direction by about 30°. Refer to Fig 1-15

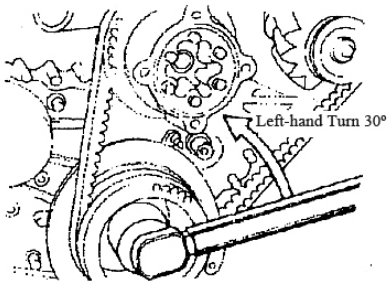


Fig 1-15

(3)Loosen the injection pipe of the 1st cylinder, then detach the spring and discharge valve on the bracket of discharge valve, and then mount the bracket for discharge valve on the fuel injection pump. Refer to Fig 1-16

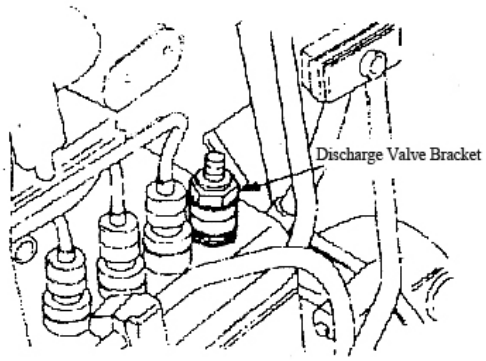


Fig 1-16

(4)Slow turn the crankshaft in the clockwise direction, at the same time while fuel feed pump is compressing and delivering fuel, and stop turning the crankshaft when the level of the first end for bracket of discharge valve has risen to the stop position. Confirm the mark of pointer symbol. Refer to Fig 1-17.

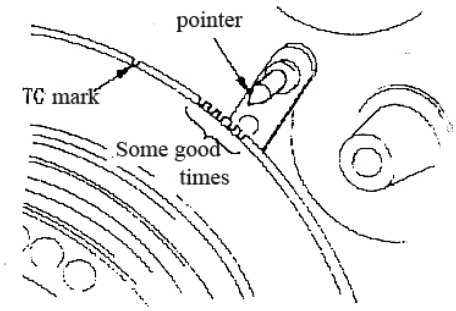


Fig 1-17

1.5.8 Adjustment of Ignition Time for Fuel Injection

(1)Dismantle the pipe mounted on the injection pump (fuel and lubricating oil).

(2)Loosen the mounting bolts for the injection pump.

(3)Adjust towards the direction far away from engine in the “Advance” case, and adjust towards the direction near to engine in the “Delay” case, at the same time while ignition time is being confirmed according to the key points of 1.5.7.

(4)Tighten all the bolts assembled for injection pump, and confirm the ignition time again, after adjustment is completed.

(5)Assemble the oil drain valve used for the first cylinder, and assemble the respective pipes at their original separate positions.

1.5.9 Determination of Compression Pressure (Refer to Fig 1-18.)

(1)Detach the heating spark plug and injection pipes totally.

(2)Fit on the pressure gauge in the assembling part for heating spark plug of the first cylinder (calibrated value as 500N/cm ^{2}).

(3)Use fully charged battery to allow the rotation of starting device, and measure the pressure at this point.

(4)Measure up to the 6th cylinder with the same method, and measure for more than two times, respectively. Then figure out their respective average values, Compression Pressure: 304N/cm ^{2} (Limit Value 255N/cm ^{2})

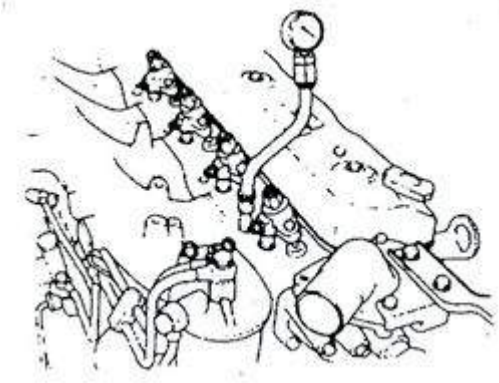


Fig 1-18

1.5.10 Exhaust of Injection Pump (Refer to Fig 1-19.)

(1)Loosen the exhaust plug for injection pump.

(2)Operate the hand pump slowly, until no air bubble appears in the place of exhaust plug.

(3)Then tighten the exhaust plug.

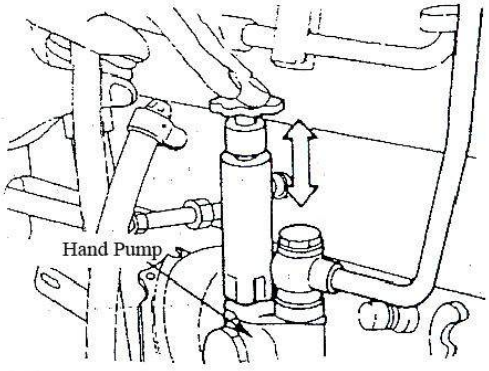


Fig 1-19

2. Electrical System

2.1 Overview

Electrical system is a negative earthed single-wire circuit. It is compared to the "Nervous System" of forklift trucks. The electrical system is mainly composed of several units as follows (Electrical Schematic Diagram as indicated in Fig 2-1).

1) Charging System

It is composed of generator, battery, and charging indicator light, etc, to provide the forklift trucks with power supply for power consumers, Voltage: DC24V.

2) Starting System

It is mainly comprised of preheating system, start switch, start protective circuit, and starter, etc, and its function is to start engine.

3) Shutdown Control System

Shutdown control system mainly consists of start switch, flameout relay, and flameout stay wire/flameout solenoid valve, etc.

4) Instrument System

It mainly includes hour meter, and oil quantity gage, as well as charging indicator light, oil pressure indicator light, neutral position indicator light, air filter blockage warning light, and oil-water separator indicator light, etc, as the test equipment on forklift truck.

5) Lighting and Signal Equipment

It includes various illuminations, signal lights and horn, as well as buzzer, etc.

Front Headlight: 70W

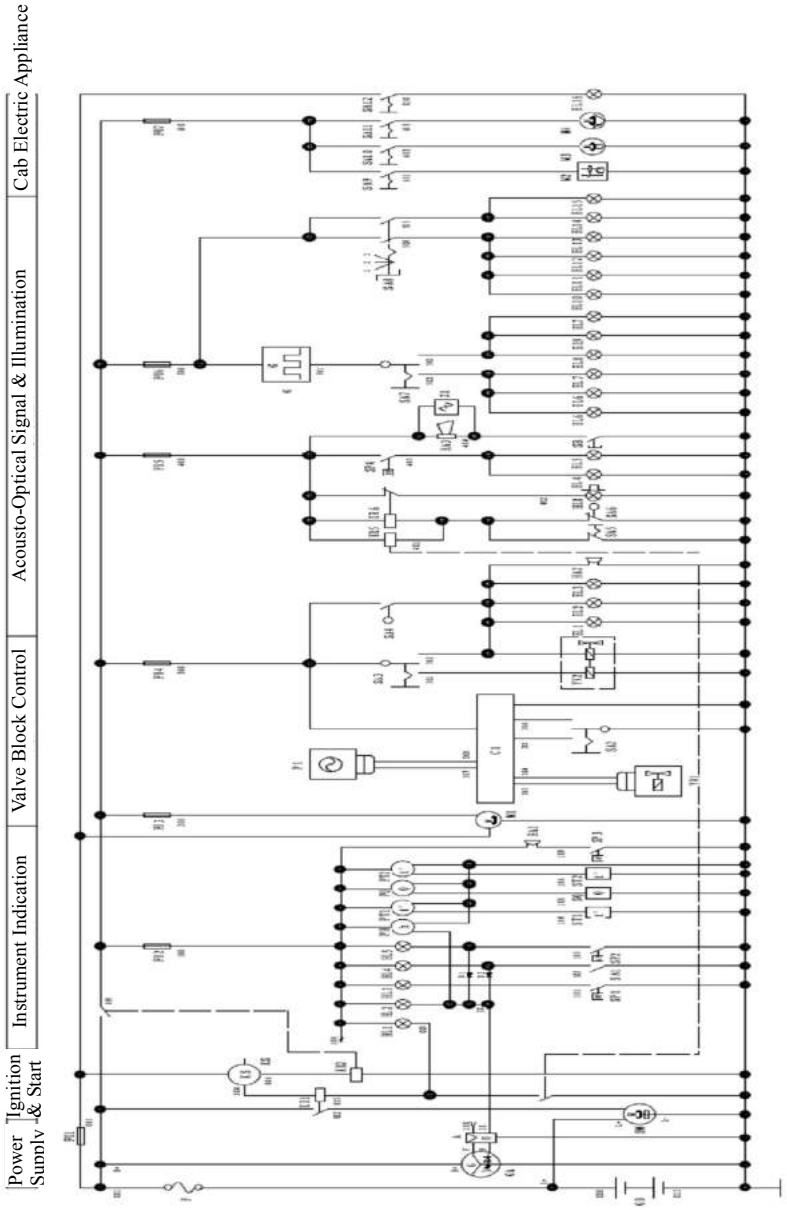
Front Combination Light (Steering/Width) 21W/8W

Rear Combination Light (Steering/Width/Reversing/Brake): 21W(Yellow) /8W(Yellow) /10W(White) /21W(Red)

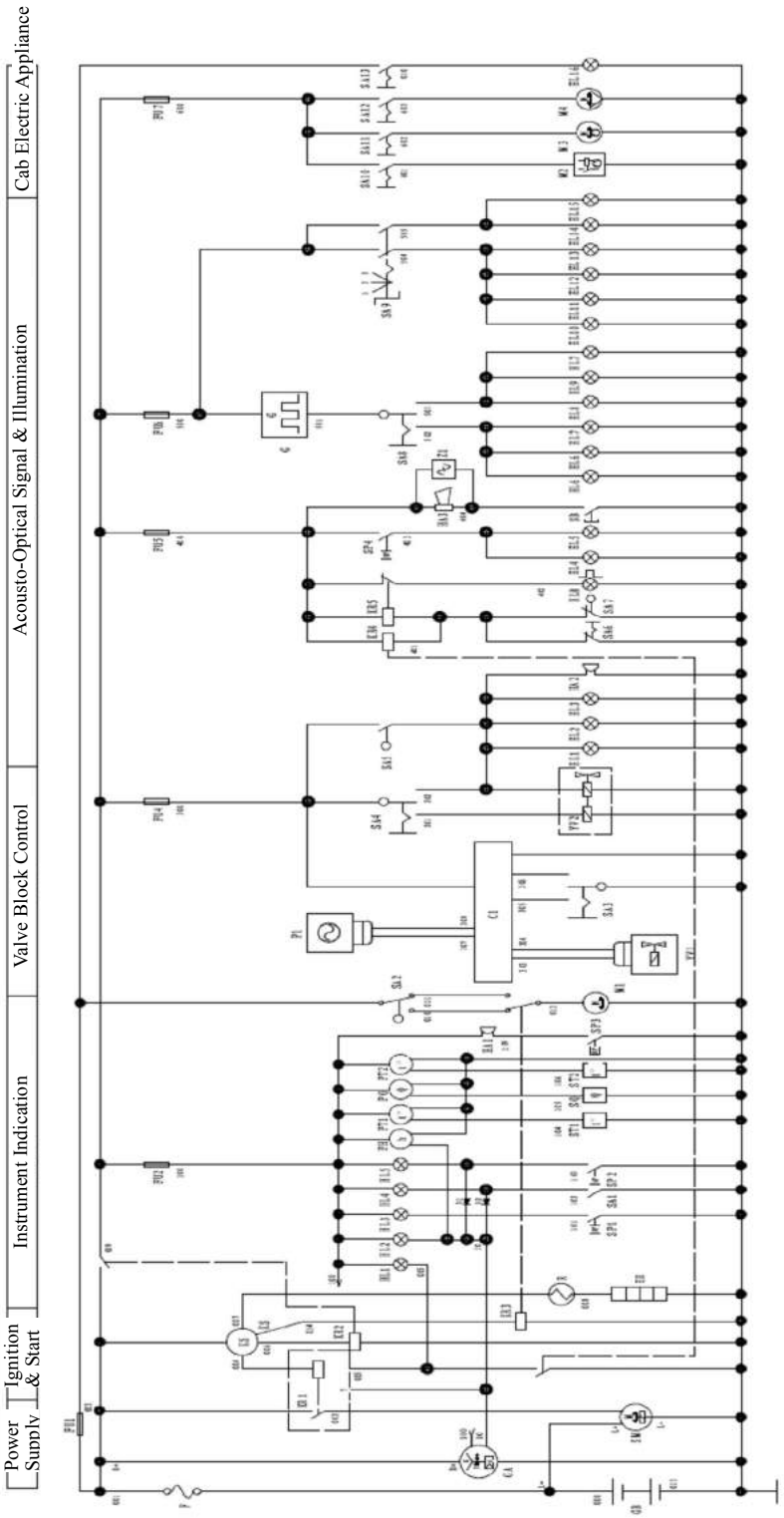
Caution Light (Optional Part): 21W

Rear Headlight (Optional Part): 70W

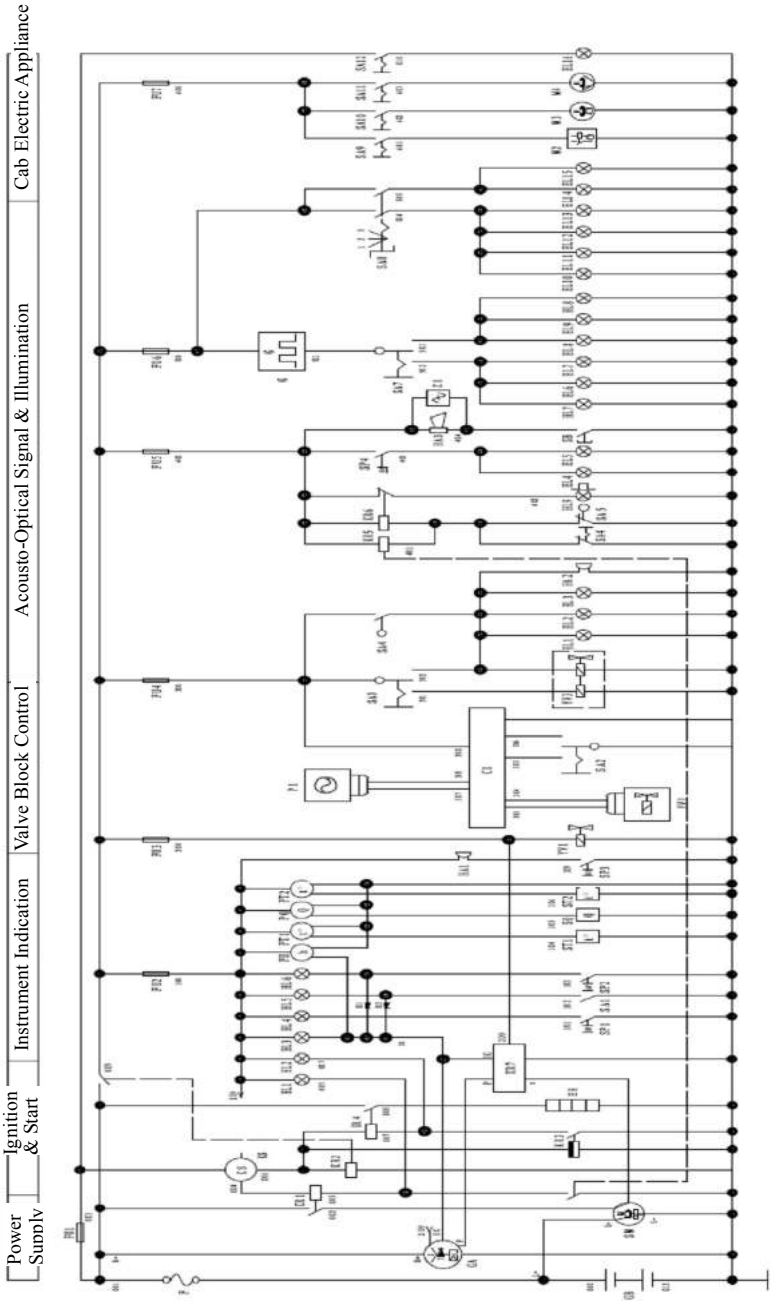
License Plate Light (Optional Part): 10W



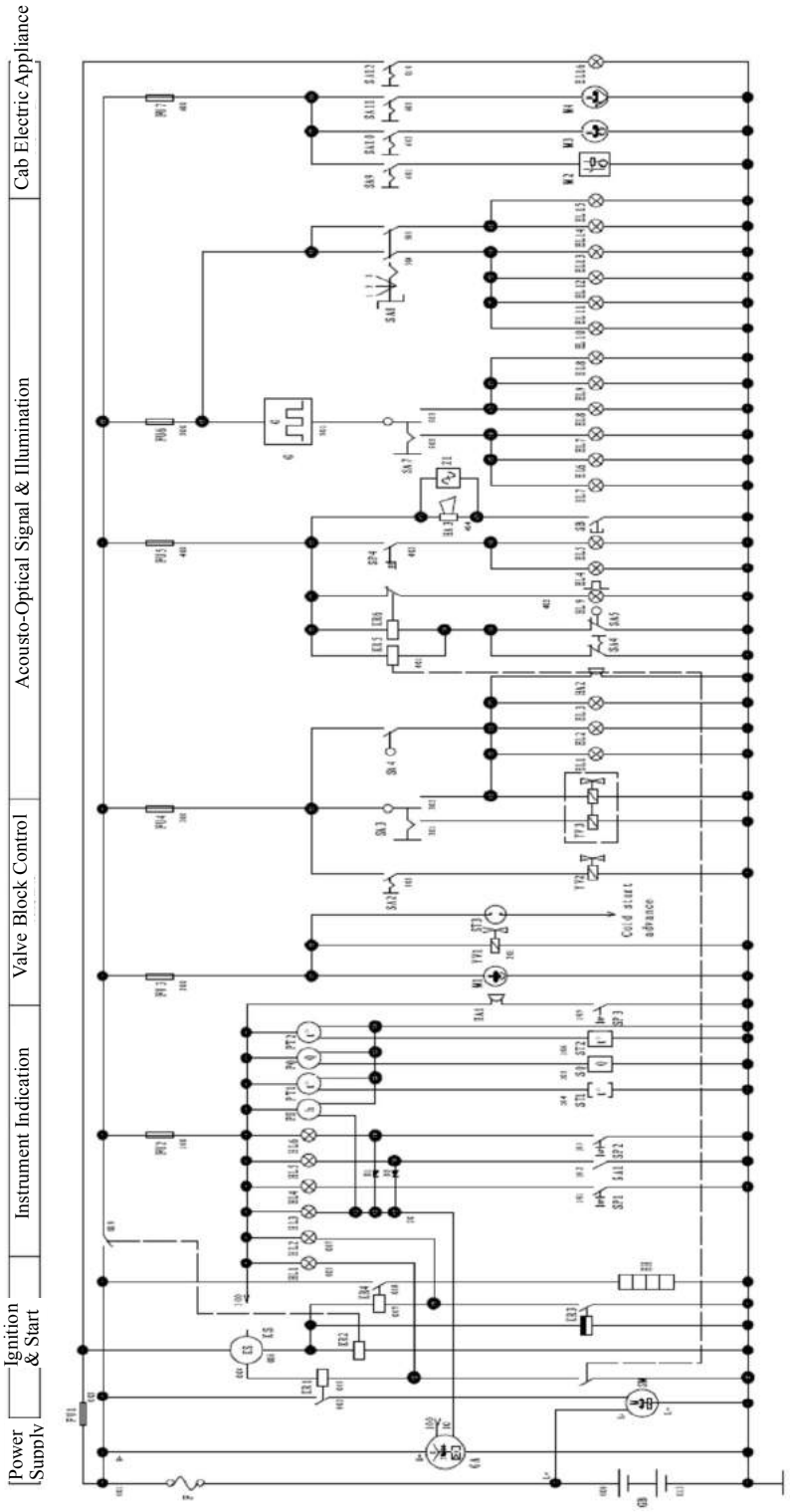
5-10t MWF(6102)Electrical Schematic Diagram



5-10 t MGH(6BG1) Electrical Schematic Diagram



5-7 t MWJ (S6S-T) Electrical Schematic Diagram



5-7 t MWH(1104D-44TA) Electrical Schematic Diagram

2.2 Brief Introduction about Operation

1) Start

Before engine is started, it is required to place the gear-shift lever at the zero position (At this point the neutral position indicator light turns on.), and otherwise, the engine won't be started, as this because the safety start protective function is designed for the forklift truck in the start protective circuit.

Turn the start switch in the counterclockwise direction to H gear (preheating position), the resistance wire of preheating indicator changes slowly, and the inlet air of engine is heated at this point, to benefit start. Turn the start switch in clockwise direction to 1st gear, and the power supply for instrument system is connected. (The truck types except Isuzu trucks will preheat automatically at the switched-on gear, and the preheating indicator light on the instrument turns on during preheating.). The schematic diagram for positions of start switch is indicated as in Fig 2-2.

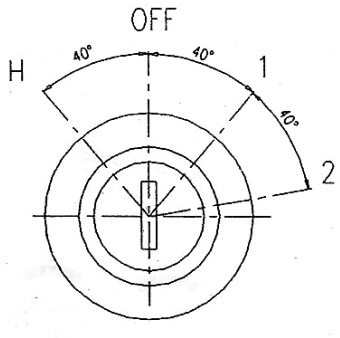


Fig 2-2 Schematic Drawing for Gear Positions of Start Switch

Turn the start switch in clockwise direction to the 2nd gear (Start Gear), to start the engine.

After engine is started, push the gear-shift lever forward, namely at the forward gear, and accelerate the throttle, the forklift truck will run at a quick speed or work at a quick speed, and if the gear-shift lever is pulled backwards, namely at the backward gear, the reversing light will turn on and the reversing buzzer sounds at this point.

2) Light Switch: Turn to the 1st gear, the front and rear width lights turn on. Turn to the 2nd gear, the front headlight turns on, and at this point, the width light is still on.

3) Turn Signal: Pull the switch for turn signal light backwards, the turn signal lights of front combination light and rear combination light on the left side of forklift truck turn on. Push the switch for turn signal light forwards, the turn signal lights of front combination light and rear combination light on the right side of forklift truck turn on.

4) Brake Signal: When brake is required for forklift truck, push down the brake pedal with foot, and brake signal light (red) of rear combination light turns on.

5) Reversing Signal: When brake is required for forklift truck, pull the gear-shift lever backwards, the transmission will be placed at reversing gear at this point. The reversing light (white) of rear combination light turns on, and the reversing buzzer sounds.

6) Non-charging Signal Indication: Turn the start switch in clockwise direction to the 1st gear (switched-on gear), before engine is started. At this point the charging indicator light turns on, and it will automatically turn off, after engine has been started. If engine is under the working status, and charging indicator light turns on, it then indicates that failure exists with charging circuit and it is no more charging, while engine shall be shut down for examination.

7) Engine Oil Pressure Signal: Turn the start switch in clockwise direction to the 1st gear (switched-on gear), before engine is started, at this point, the oil pressure indicator light turns on, and it automatically turns off, after engine is started. If engine is under working status, and the oil pressure indicator light turns on, it then indicates that the oil pressure of engine is too low and lubrication is not satisfactory, while engine shall be shut down for examination.

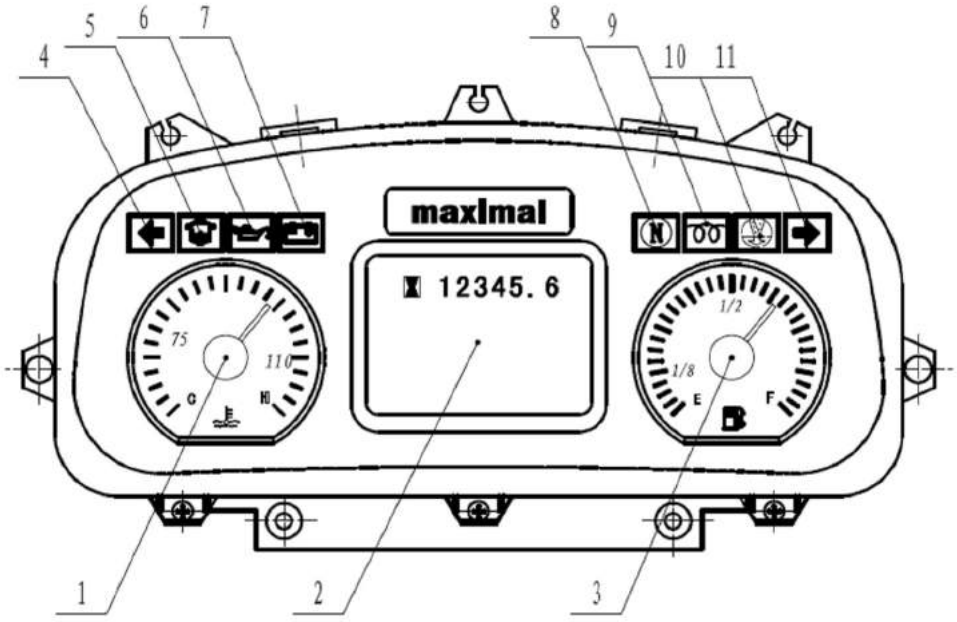
8) Oil-Water Separator Signal Display: Turn the start switch in clockwise direction to the 1st gear (switched-on gear), before engine is started, at this point, the water sedimentation signal indicator light turns on, and it automatically turns off, right after engine is started. IF engine is under the working status, and this indicator light turns on, it then indicates that water accumulation in oil-water separator has exceeded the warning water level. The accumulated water shall be discharged, and the signal light will automatically turn off, after water is discharged.

9) Fuel Gage: Indicating the storage quantity of fuel in fuel tank

10) Water Temperature Gauge: Indicating the temperature of engine coolant

11) Hour Meter: Cumulative engine working hours

Instrument schematic drawing is indicated as in Fig 2-3.



2-3 Combination Instrument

1. Water Temperature Gauge 2. Hour Meter 3. Fuel Gage

4. Left Turn Indicator Light 5. Oil-Water Separator Indicator Light 6. Oil Pressure Indicator Light

7. Charging Indicator Light 8. Neutral Position Indicator Light 9. Preheating Indicator Light

10. Air Filter Blockage Indicator Light 11. Right Turn Indicator Light

2.3 Battery

▲! Notices during Use of Battery:

(1)Battery may generate flammable gas, and has the danger of explosion. On this account, short circuit and spark generation shall be avoided, and fire work shall be strictly prohibited.

(2)Electrolyte is a dilute sulfuric acid, and it is very dangerous for it to touch skin or eyes (burn injury, and blindness). In the case when it touches skin, water shall be used for flushing immediately, while water shall be used for flushing and doctor shall be visited in time, when it splashes into the eye.

2.4 Wire Harness

1) Allowable Load Current Values for Nominal Sections of Low-pressure Wire

Section(mm^2)	0.5	0.8	1.0	1.5	2.5	3.0	4.0	5.0	6.0
Current Carrying Capacity(A)			11	14	20	22	25	25	35

2) Table for Truck Model and Wire Harness

Type / Name	50-70-MWF	80-100-MWF	50-70-MGH	80-100-MGH	50-70-MWJ	50-70-MWH
Instrument Bracket Harness	●	←	●	←	●	●
Engine Harness	●	←	●	←	●	●
Overhead Guard Harness	One Page in Total					

3. Transmission Device

Transmission device is mainly comprised of two parts including torque converter and transmission.

Refer to Table 3-1 for main parameters, and refer to Fig 3-1 for structure of transmission device.

Table 3-1

Item			Unit	Structural Feature or Parameter
Torque Converter	Type			Three-element, Single-stage, and 2-phase Type
	Circulating Circle Diameter and Torque Conversion Ratio			12.5”(Φ315)Torque Conversion Ratio 3.1
	Set Oil Feed Pressure		MPa	0.5～0.7
Oil Feed Pump	Type			Internal Gear Pump, and Transmission Power Output
	Flow Rate		1/min	40(2000rpm, at 2MPa)
Transmission	Type			Power Gear Shift
	Number of Transmission Gears			2 Gears for Front and Rear, Respectively
	Speed Ratio (The Same for Both Front and Rear)			I：1.852 / II：0.642
	Hydraulic Clutch	Friction Plate	mm	Outer Diameter Φ134/ Inner Diameter Φ90/ Thickness 2.8
		Friction Surface Area	cm^2	77.4
		Set Pressure	MPa	1.2～1.5
Mass			kg	About 295
Oil Quantity			1	About 20
Oil Brand				6# Torque converter oil(Equivalent to SAE10W)

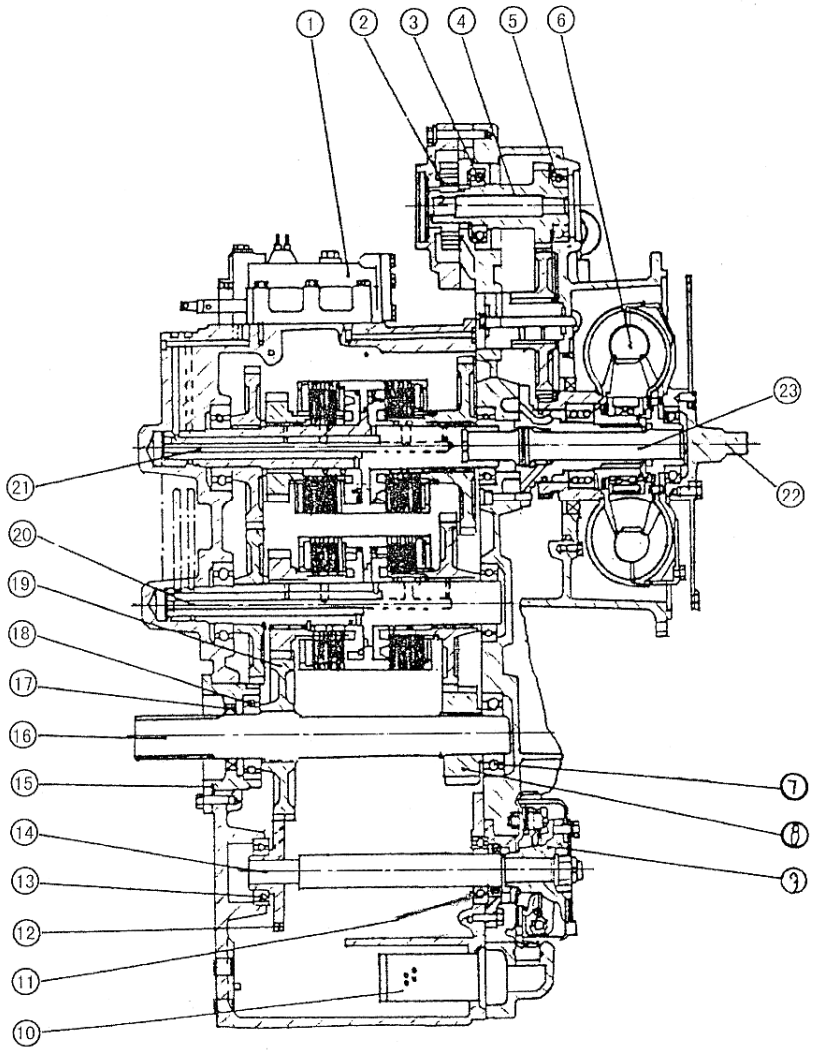


Fig 3-1 Hydraulic Transmission

1. Control Valve
2. Oil Feed Pump
3. Ball Bearing
4. Shaft
5. Ball Bearing
6. Torque Converter
7. Ball Bearing
8. Gear
9. Parking Brake
10. Oil Filter
11. Oil Seal
12. Gear
13. Ball Bearing
14. Shaft
15. Bearing Cover
16. Output Shaft
17. Oil Seal
18. Ball Bearing
19. Gear
20. Backward Gear Clutch Subassembly
21. Forward Gear Clutch Subassembly
22. Elastic Pad (Input Pad)
23. Transmission Input Shaft

3.1 Overview

The hydraulic transmission selected and used for this forklift truck is composed of torque converter and transmission with power gear shift, and it is typical of following features:

(1) Fitted with inching valve, which has improved the inching performance, and on this account, the forklift truck is able to maintain an inching performance when it is started or running at any rotating speed

(2) The friction plate of hydraulic clutch is formed with 7 pieces of steel sheets and 7 pieces of specially treated paper friction plates, which has therefore ensured it to have a relatively satisfactory durability.

(3) The torque converter used has one-way clutch, which has therefore enhanced the transmission efficiency.

(4) Oil filter is mounted in the oil circuit for torque converter, which has improved the cleanliness of oil, and namely prolonged the service life of torque converter.

3.2 Torque Converter

Generally, the torque converter with single-stage three elements is composed of the pump impeller mounted on input shaft, the turbine installed on output shaft, and the guide pulley fixed on the case of torque converter.

The pump impeller is actuated by elastic pad, and the elastic pad is connected with flywheel. At the same time while engine is rotating, the pump impeller begins rotation as well. Due to the effect of centrifugal force, the liquid inside the pump impeller ejects along the blade lattice of pump impeller (at this point it is transformed from mechanical energy into hydraulic energy.).

Thus, the liquid flows into the blades of turbine, to transmit the moment of force to the output shaft. The change in direction of liquid leaving turbine takes place under the action of guide pulley, for it to flow into the pump impeller at a maximal angle, and at the same time, a moment of reactive force is generated to push the guide pulley for the output torque to be larger by one moment of force at the equivalent value of this reactive moment compared with the input torque.

When rotating speed of turbine is increased and approaches the input rotating speed, the angle of liquid flow turns to be reduced, and the torque on output shaft is decreased along with, and in the end, the liquid flow begins to flow into the blade lattice of guide pulley in a reverse direction, for a reverse effect to be generated for the abovementioned reactive moment. In this case, the torque on output shaft is smaller than the torque on input shaft, and one one-way clutch is fitted inside the guide pulley, to prevent the occurrence of this effect. The guide

pulley will rotate freely, when the abovementioned reactively moment effects reversely, and under such working condition, the input torque is equal to the output torque, this to ensure a high-efficiency work.

The torque converter changes the transmission of moment of force depending on mechanical method (clutch), and it plays the two functions of coupler and torque converter, hence called two phases. It is characterized by stable operation and improved efficiency.

One-way clutch, turbine, pump impeller, and guide pulley are installed inside the torque converter, and the internal part of the torque converter is filled up with torque converter oil, with warning point of oil temperature as 105℃.

One gear in the end part of pump impeller is mutually engaged with the driving gear of oil feed pump, to actuate the oil feed pump.

Turbine is coupled with the input shaft (transmission) using spline, and it plays the function for power to be transmitted to hydraulic clutch.

Refer to Fig 3-2 for structure of torque converter.

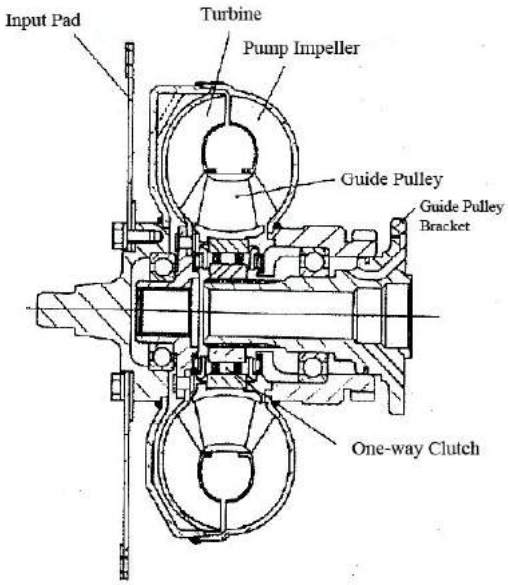


Fig 3-2 Torque Converter

3.3 Oil Feed Pump

Refer to Fig 3-3 for structure of oil feed pump.

Oil feed pump is composed of driving gear, and internal gear (driven gear), as well as housing, and cover, installed on the upper end of torque converter case. The driving gear is actuated by pump impeller, neutral-position gear, and driving gear of oil pump of torque converter, and the oil feed pump supplies oil in the lower part of transmission to respective parts of the transmission.

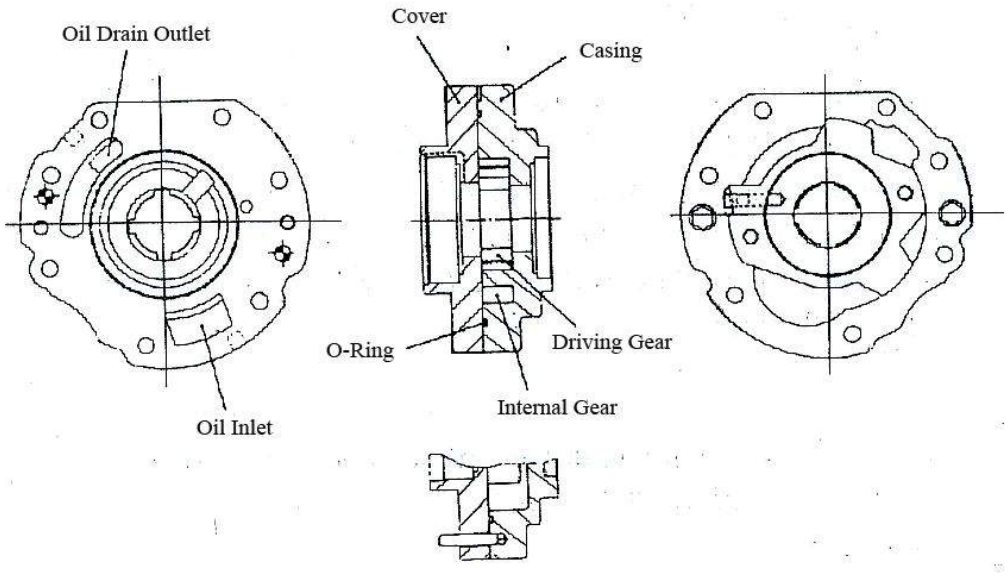


Fig 3-3 Oil Feed Pump

3.4 Hydraulic Clutch

Refer to Fig 3-4 for forward gear clutch, and refer to Fig 3-5 for backward gear clutch.

Hydraulic clutch is installed inside the transmission, and the driving gear on the side of wet multi-disc is engaged with its corresponding driven gear, while the driving gear on the side of backward-gear clutch is engaged with its opposite shaft gear.

Six friction plates manufactured with sintered material and 7 steel spacers are contained, inside one clutch unit, and they are alternately assembled and mounted together with pistons.

During operation, the sealing property for external circle and internal circle of piston is respectively ensured by slide oil seal and O-ring. Under the status out of service, the disc return spring is disengaged from hydraulic clutch, and the surface of clutch is always lubricated by the oil returned from oil cooler, to prevent surface adhesion and wear of clutch.

When the pressure oil acts on the piston, the sintered friction plates and steel spacers alternately assembled together are pressed, and therefore the clutch as a whole transmits the power from the torque converter to the driving gear.

Accordingly, the power transmission flow between torque converter – transmission is as follows:

Turbine – Input Shaft – Clutch Drum – Steel Spacer – Sintered Friction Plate – Forward or Backward Gear – Output Shaft

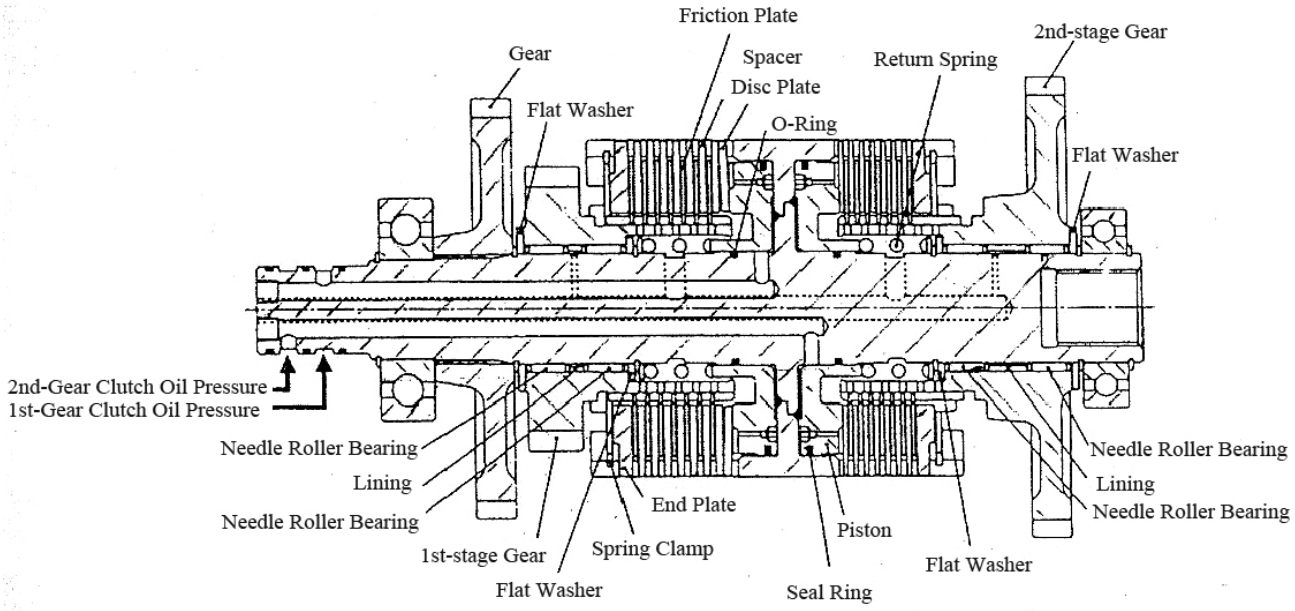


Fig 3-4 Forward-Gear Clutch

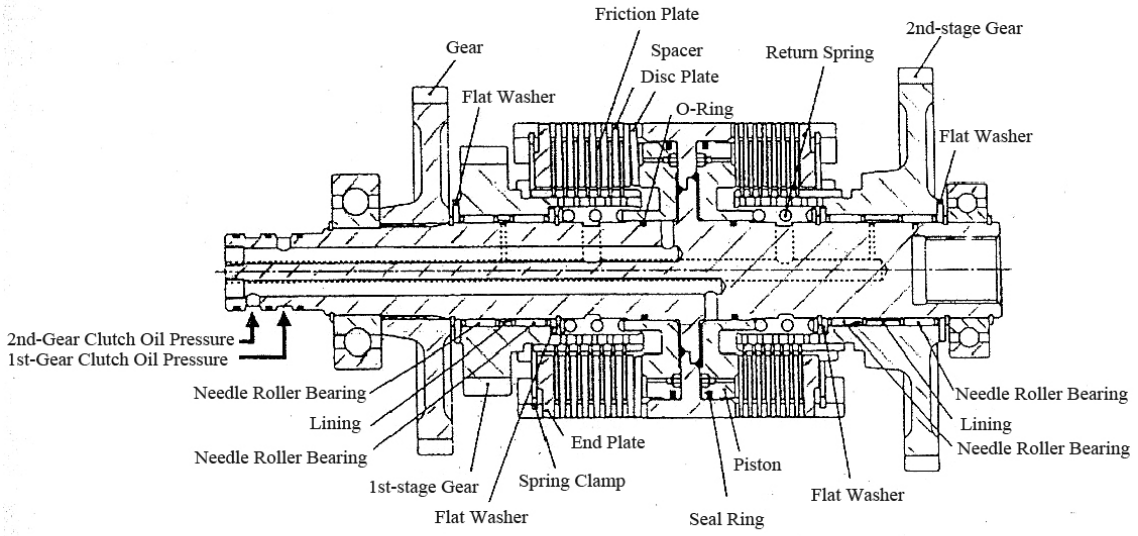


Fig 3-5 Forward-Gear Clutch

3.5 Control Valve and Inching Valve

Refer to Fig 3-6 for control valve.

Control valve is mounted in the upper part of transmission, with both gear-shift slide valve and inching slide valve fitted inside the valve body.

The overflow valve of hydraulic clutch is used to adjust the oil pressure of clutch inside the transmission, while the overflow valve of torque converter is used to adjust the oil pressure flowing into the torque converter.

Inching valve stem is mutually coupled with the connecting rod of inching pedal, and the valve stem is pressed in, when inching pedal is pushed down. Accordingly, the clutch will release, when oil pressure of clutch is temporarily dropped.

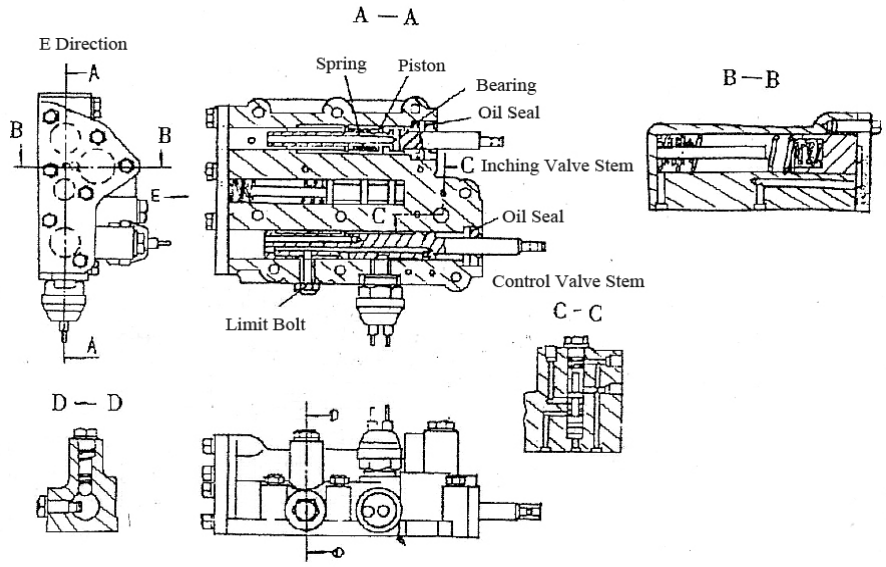


Fig 3-6 Control Valve

3.6 Oil Circuit System for Torque Converter

Refer to Fig 3-7.

After engine is started, the oil feed pump will work along with, and the oil of torque converter will pass through the oil feed pump and be forced out to the control valve from oil sump (namely the bottom of transmission) through oil filter.

The torque converter oil from oil feed pump is divided into two ways inside the case of torque converter, one used for torque converter, and the other used for transmission.

The oil pressure used for clutch inside the transmission is adjusted to 1.2～1.5MPa through pressure regulating valve, while the oil pressure used for torque converter is adjusted to 0.5～0.7MPa through adjusting valve of torque converter. The pressure oil will afterwards reach the blade lattice of torque converter, to lubricate the clutch unit after being cooled down through oil cooler, and then return to the oil sump through oil filter, recycled in such a way.

When gear-shift valve stem is at the middle position (neutral gear), the oil circuit from gear-shift slide valve to clutch is closed, and at this point, all the liquid will flow into the torque converter.

When gear-shift valve stem is at forward or backward position, for the action of pressure regulating valve, the oil enters into pressure accumulator, and therefore, oil pressure is gradually increased during the period when clutch begins its action to full compression.

When pressure oil is filled up inside the pressure accumulator, the oil pressure is sharply increased, for the hydraulic clutch to achieve a full engagement. When forward-gear or backward-gear clutch is working, another kind of clutch (backward or forward) is under the disengaged status, the oil from oil cooler lubricates it, to prevent adhesion between respective plates, and to play a cooling function.

When inching pedal is pushed down, the inching valve takes action. Most oil inside the clutch will be extracted through inching valve and return to the bottom of transmission (oil sump), and the oil circuit is the same as the status at neutral gear.

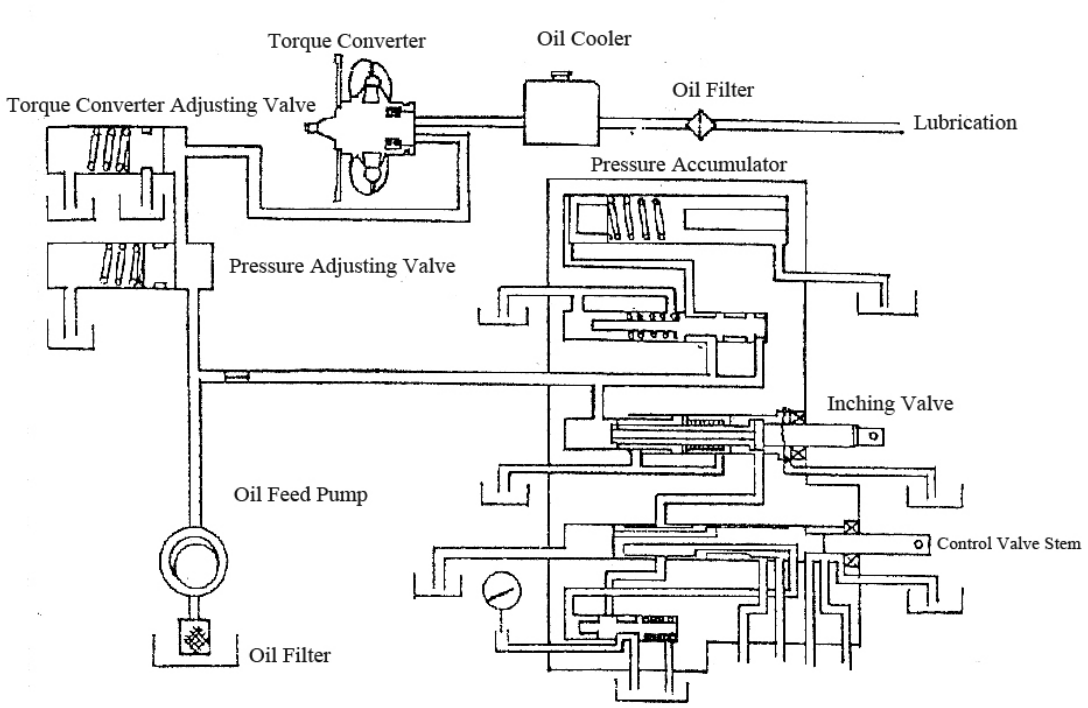


Fig 3-7 Torque Converter Oil Circuit System

3.7 Notices during Failure Occurrence with Forklift Truck

Attention must be paid to the following requirements, when forklift truck cannot run due to its own failure and other equipment is needed to drag it:

(1) Demount the drive shaft between transmission and speed differential.

(2) Place the gear-shift lever at the middle position (neutral gear).

This is because the oil feed pump cannot perform normal lubrication when it is out of service, and it may possibly give rise to adhesion, if rotation of drive wheel is transmitted to the gear of transmission and the clutch. (Hence the drive shaft shall be detached.)

3.8 Failure Removal

(1) Insufficient Power: Refer to Table 3-2.

(2) Abnormal Rise of Oil Temperature: Refer to Table 3-3.

(3) Loud Noise with Transmission: Refer to Table 3-4.

(4) Low Transmission Efficiency: Refer to Table 3-5.

(5) Oil Leak; Refer to Table 3-6.

Table 3-2 Insufficient Power

Part	Cause for Failure Generation	Examination Method	Removal Method
Torque Converter	A. Too Low Oil Pressure		
	(1)Oil Level Low	Examining oil level	Oil to be added
	(2)Air Sucked at the Oil Suction Side	Examining joint and oil pipe	Joint to be re-tightened and sealing part to be replaced
	(3)Oil Filter Blocked	Disassembling and examining	To be cleaned or replaced
	(4)Displacement of Oil Feed Pump Insufficient	Disassembling and examining	To be replaced
	(5)Main Overflow Valve Disc Spring Distorted	Examining spring tension	
	(6)Seal Ring or O-Ring Damaged or Worn out	Disassembling and examining	To be replaced
	B. Flywheel Damaged or Other Parts in Collision	Extracting a small quantity of oil and examining whether or not extraneous substance exists	To be replaced
Transmission	A. Improper Use of Oil or Blistering	Examining	
	(1)Air Sucked at Oil Suction Side	Examining joint and oil pipe	Joint to be re-tightened or replaced
	(2)Oil Pressure of Torque Converter too Low or Blistering	Measuring pressure	Pressure to be adjusted
	B. Clutch Skidding		
	(1)Oil Pressure Low	Measuring Pressure	Pressure to be adjusted
	(2)Seal Ring Worn out	Disassembling, examining, and measuring	To be replaced
	(3)Clutch Piston Ring Worn out	Disassembling and examining	
	(4)Friction Plate Worn	Disassembling and examining start	To be replaced

	out and Sheet Steel Distorted	engine, and putting the gear-shift lever respectively at forward, backward, and middle position, while forklift truck running forward at middle position, and the truck not working at backward	
	C. Positions of Inching Connecting Rod and Gear-Shift Valve Rod Incorrect	Examining and measuring	To be adjusted
Engine	Engine Power Reduced	Examining rotating speed at stall Examining the sound during work of engine, and examining the maximum rotating speed at middle position (at neutral position)	Engine to be adjusted or repaired

Table 3-3 Abnormal Rise of Oil Temperature

Part	Cause for Failure Generation	Examination Method	Removal Method
Torque Converter	(1)Oil Level Low	Examining oil level	Oil to be added
	(2)Oil Filter Blocked	Disassembling and examining	To be cleaned or replaced
	(3)Collision between Flywheel and Other Parts	Draining oil in oil filter or oil sump and examining whether or not extraneous substance exists	To be replaced
	(4)Air Sucked	Examining the joint and oil pipe at the end of suction	Joint to be tightened or gasket to be replaced
	(5)Water Blended into Oil	Discharging oil and examining	Oil to be replaced
	(6)Oil Flow Rate Low	Examining whether or not pipeline is damaged or bent	To be rehabilitated or replaced
	(7)Bearing Worn out or Blocked	Disassembling and examining	To be rehabilitated or replaced
Transmission	(1)Clutch Skidding	Gear shift lever to be placed at neutral position Examining whether or not forklift truck is running	Friction plate of clutch to be replaced
	(2)Bearing Worn out of Blocked	Disassembling and examining	To be replaced

Table 3-4 Loud Noise with Transmission

Part	Cause for Failure Generation	Examination Method	Removal Method
Torque Converter	(1)Elastic Pad Broken	Examining rotating sound, at low speed	Elastic pad to be replaced
	(2)Bearing Damaged or Worn out	Disassembling and examining	To be replaced
	(3)Gear Broken	Disassembling and examining	To be replaced
	(4)Spline Worn out	Disassembling and examining	To be replaced
	(5)Loud noise with Oil Feed Pump	Disassembling and examining	To be rehabilitated or replaced
	(6)Bolt Loosened	Disassembling and examining	To be tightened or replaced
Transmission	(1)Bearing Worn out or Blocked	Disassembling and examining	To be replaced
	(2)Gear Broken	Disassembling and examining	To be replaced
	(3)Spline Worn out	Disassembling and examining	To be replaced
	(4)Bolt Loosened	Disassembling and examining	To be tightened or replaced

Table 3-5 Low Transmission Efficiency

Part	Cause for Failure Generation	Examination Method	Removal Method
Torque Converter	(1)Elastic Pad Broken	Examining rotating sound at low speed, and examining whether or not the front cover rotates	To be replaced
	(2)Oil Quantity Insufficient	Examining oil level	Oil to be added
	(3)Drive System of Oil Feed Pump out of Order	Disassembling and examining	To be replaced
	(4)Shaft Broken	Disassembling and examining	To be replaced
	(5)Oil Pressure too Low	Examining whether or not suction pressure is formed at oil inlet side of oil feed pump	To be replaced
Transmission	(1)Oil Quantity Insufficient	Examining oil level	Oil to be added
	(2)Seal Ring Damaged	Disassembling and examining	To be replaced
	(3)Clutch Lamella Skidding	Examining clutch oil pressure	To be replaced
	(4)Shaft Broken	Disassembling and examining	To be replaced
	(5 Clutch Cover Broken	Disassembling and examining	To be replaced
	(6)Spring Retainer Ring of Clutch Cover Broken	Disassembling and examining	To be replaced
	(7)Extraneous Substance Present in Clutch Oil Tank	Disassembling and examining	To be cleaned or replaced
	(8)Spline Part of Shaft Worn out	Disassembling and examining	To be replaced

Table 3-6 Oil Leak

Part	Cause for Failure Generation	Examination Method	Removal Method
Torque Converter and Transmission	(1)Oil Seal Damaged	Disassembling and examining, whether or not oil seal lip or other loosened fitting parts are worn out	Oil seal to be replaced
	(2)Casing Connection Incorrect	Examining	Gasket to be tightened or replaced
	(3)Joint and Oil Pipe Loosened	Examining	Pipe to be tightened or replaced
	(4)Oil Drain Plug Loosened	Examining	To be tightened or replaced
	(5)Oil Ejected out from Vent Hole	Discharging oil and examining whether or not water is blended into oil, examining whether or not air is sucked in the oil suction joint, and examining the vent hole of air breather	Oil to be replaced, to be tightened or replaced, and seal to be rehabilitated
	(6)Oil Quantity Excessive	Examining oil level	Excessive oil to be drained

4. Drive Axle

Refer to Table 4-1 for main parameters of drive axle.

Table 4-1

Item \ Forklift Truck Tonnage		5-7t	8-10t
Type of Drive Axle		Full Floating Type and Cast Steel Axle	
Main Transmission	Type	Spiral Bevel Gear Type	
	Reduction Ratio	4.875	6.33
Wheel-sided Reducer	Type	Planetary Gear Type	
	Reduction Ratio	4.25	3.67
Total Reduction Ratio		20.72	23.23
Oil Capacity	Main Transmission and Speed Differential	10 I	
	Wheel-sided Reducer	Left and Right 8 I in Total	Left and Right 10 I in Total
Wheel	Tyre (Two for Left and Right, Respectively)	8.25-15-14PR	9.00-20-14PR
	Wheel Rim	6.50-15	7.0-20
	Air Pressure kPa	830	760

4.1 Overview

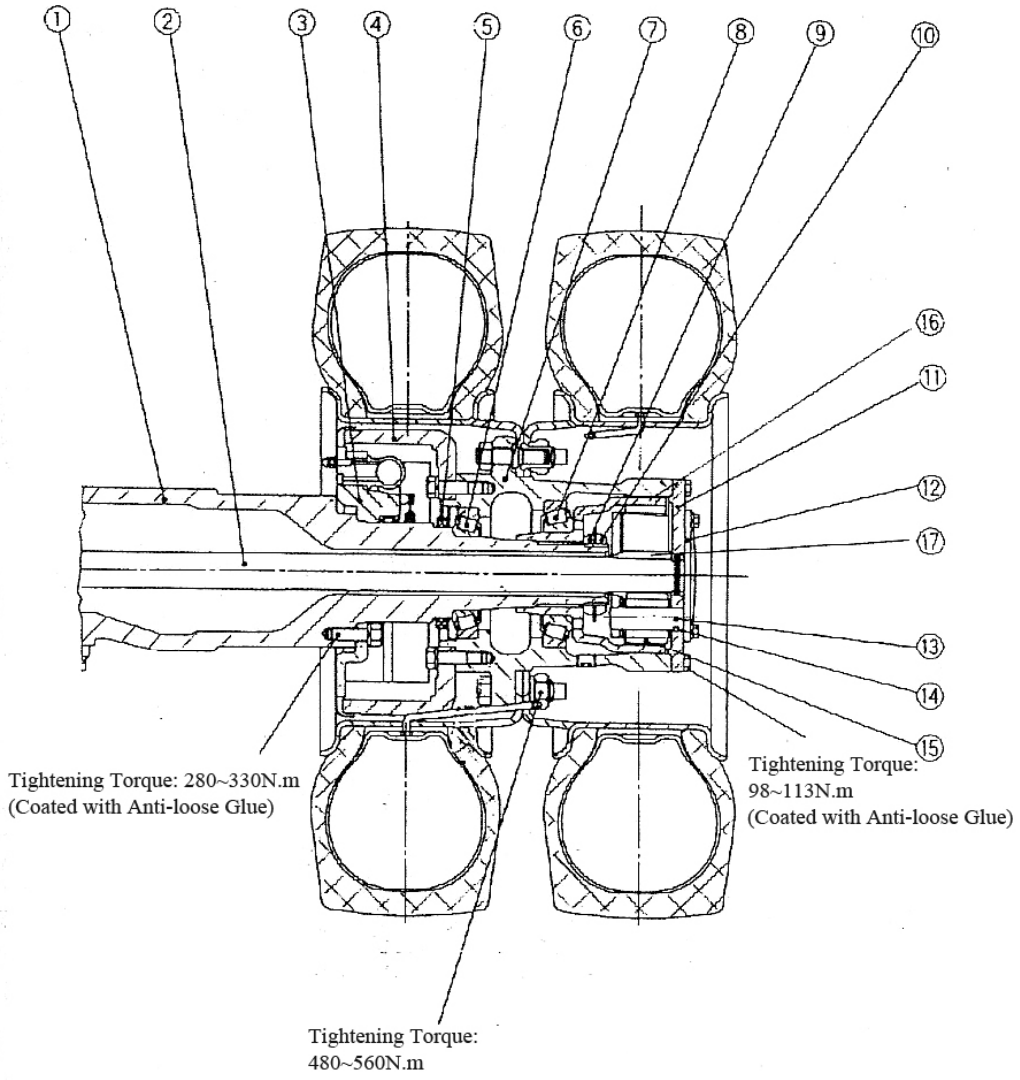
Drive axle is composed of main transmission, speed differential, wheel-sided reducer, and wheel brake, etc. Refer to Fig 4-1 and Fig 4-2. The drive axle is coupled with the sector plate in front part of truck frame using bolts, while mast is mounted on the drive axle housing.

4.2 Main Transmission and Speed Differential

Main transmission and speed differential are mainly comprised of left and right differential cases, gear ring (spiral bevel gear), and driving pinion, etc, and they are all mounted inside the case of main transmission, as indicated in Fig 4-3.

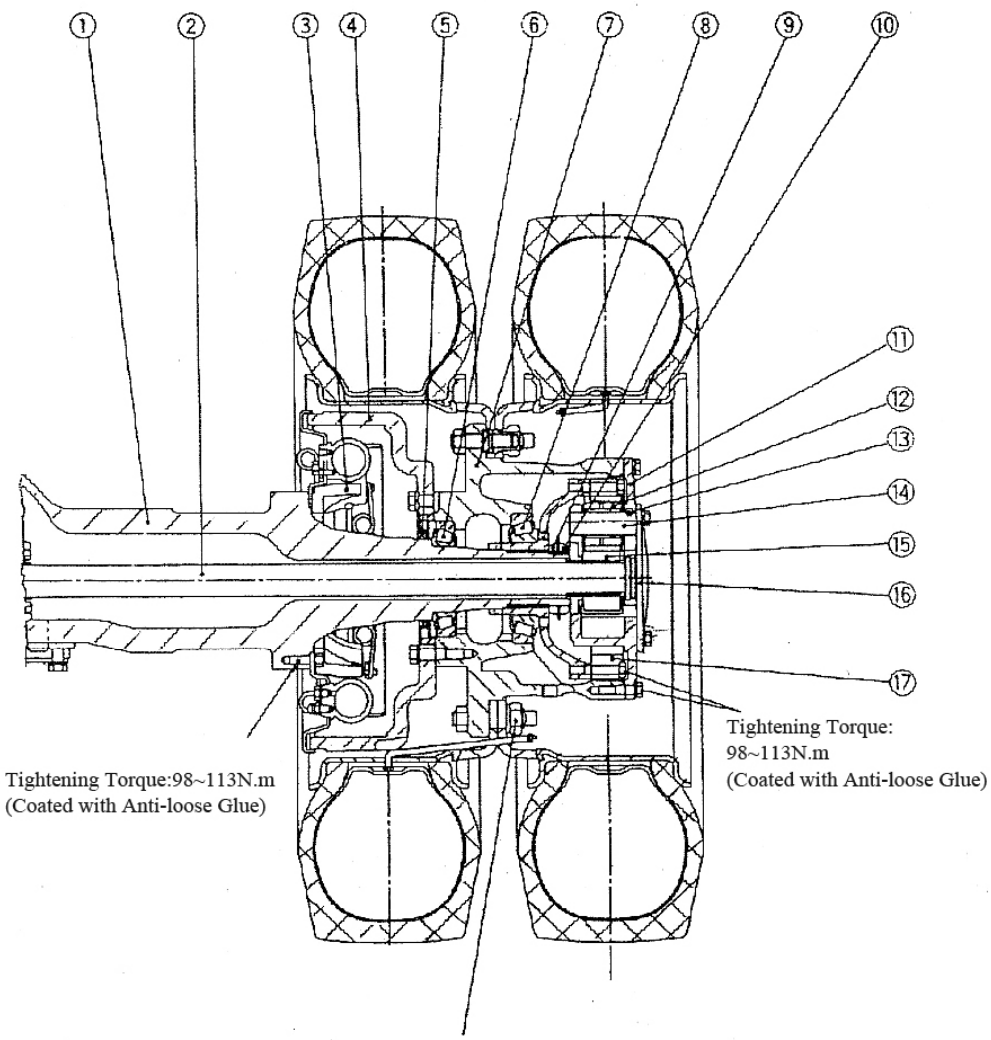
The speed differential is in split type. The left and right differential cases are coupled with each other using bolts, with half-shaft gear and the planetary gear (fixed onto the cross shaft) assembled inside, and these two types of gears are mutually engaged.

The driving pinion shaft is supported by two tapered roller bearings fitted inside the bearing seat. The bearing seat is fixed with the case of main transmission using gasket and padding. The gear ring is in a spiral bevel gear type, and it is prized onto the right differential case using bolts, while the speed is reduced for the power transmitted from transmission through pinion (shaft) and gear ring.



1. Axle Housing
2. Half Shaft
3. Brake
4. Brake Drum
5. Oil Seal
6. Tapered Roller Bearing
7. Wheel Hub
8. Tapered Roller Bearing
9. Adjusting Nut
10. Lock Nut
11. Planetary Gear Carrier
12. End Cap
13. Shaft
14. Steel Ball
15. Planetary Gear
16. Gear Ring
17. Sun Gear

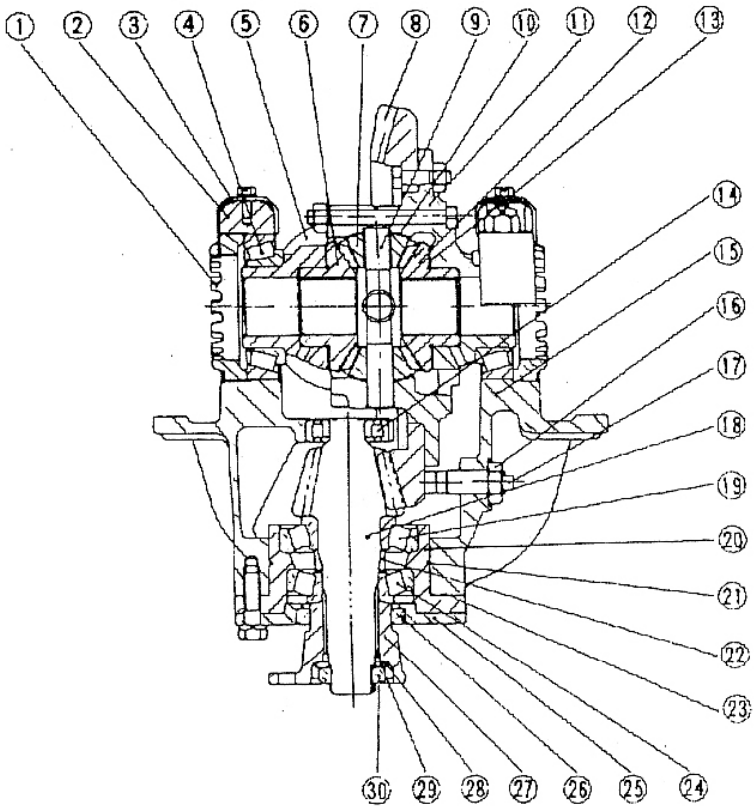
Fig 4-1 Drive Axle (5-7t)



1. Axle Housing	6. Tapered Roller Bearing	11. Planetary Gear Carrier	16. End Cap
2. Half Shaft	7. Wheel Hub	12. Planetary Gear	17. Gear Ring
3. Brake	8. Tapered Roller Bearing	13. Steel Ball	
4. Brake Drum	9. Adjusting Nut	14. Shaft	
5. Oil Seal	10. Lock Nut	15. Sun Gear	

Fig 4-2 Drive Axle (8-10t)

Fig 4-3 Main Reducer and Differential



1. Adjusting Nut
2. End Cap
3. Lock Plate
4. Tapered Roller Bearing
5. Differential Shell (Left)
6. Half Shaft Gear
7. Planetary Gear
8. Spiral Bevel Gear
9. Cross Shaft
10. Thrust Gasket
11. Differential Shell (Right)
12. Half Shaft Gear
13. Thrust Washer
14. Roller Bearing
15. Main Reducer Case
16. Lock Nut
17. Adjusting Bolt
18. Driving Gear Shaft
19. Tapered Roller Bearing
20. Bearing Seat
21. O-Ring
22. Lining
23. Adjusting Shim
24. Tapered Roller Bearing
25. Oil Seal Bracket
26. Oil Seal
27. Flange
28. O-Ring
29. Gasket
30. Lock Nut

4.3 Wheel-sided Reducer

The wheel-sided reducer includes one sun gear, one unit of planetary gears, and one internal gear ring. The two sets of wheel-sided reduction gear devices are respectively installed on the two ends of drive axle housing. The sun gear is mounted on the half shaft using spline and retained by retainer ring using spring. The planetary bracket is fitted on the wheel hub, and one unit of planetary gears is respectively mounted on the shaft of one unit of planetary gears fitted inside the planetary bracket. The internal gear ring (or through the seat of internal gear ring) is assembled on the drive axle housing using spline.

The principle for power transmission is as follows: Refer to Fig 4-4.

When sun gear rotates (namely the rotation of half shaft), the rotation is transmitted to the planetary gears and the internal gear ring. However, as the internal gear ring is fixed on the two ends of drive axle housing, the planetary gear will rotate around the sun gear, and it rotates automatically at the same time. The planetary gear is mounted on the bracket of the planetary gear while this bracket is mutually coupled with wheel hub, the wheel rim is also linked with the wheel hub, and thus, the power of half shaft actuates the rotation of wheel.

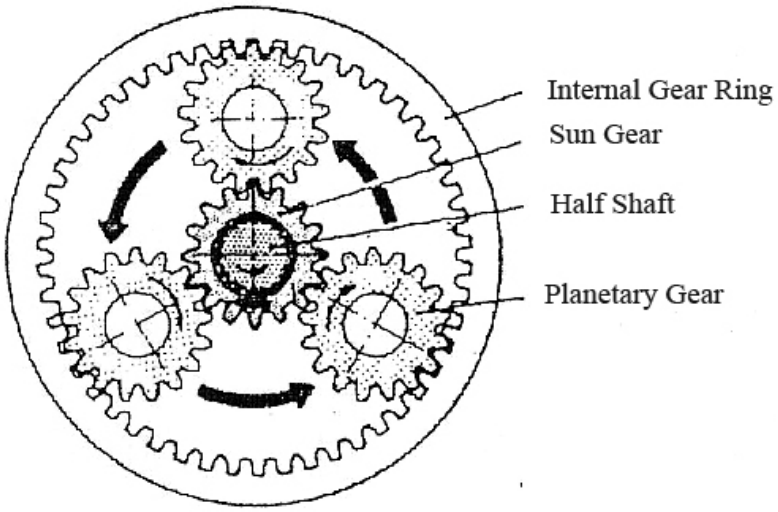


Fig 4-4 Wheel-sided Reducer

4.4 Failure Removal

Refer to the listed descriptions in Table 4-2.

Table 4-2

Failure	Cause for Failure Generation	Removal Method
1. Oil Leaked out from Main Reducer Casing	Coupling Bolt of Main Reducer Casing Loosened or Gasket Damaged	To be tightened or replaced
	Vent Hole Blocked	To be cleaned or replaced
	Oil Seal Worn out or Damaged	To be replaced
2. Loud Noise with Speed Differential	Gear Worn out, Damaged or Broken	To be replaced
	Bearing Worn out, Damaged or Broken	To be replaced
	Gear Clearance Improper	To be adjusted
	Fitting between coupling Half Shaft Gear and Spline of Half Shaft Loosened	Parts to be replaced
	Gear Oil Insufficient	Oil to be added as per requirement

4.5 Maintenance Data

Refer to Table 4-3.

Table 4-3

Part	Item	Standard Value(㎜)
Speed Differential	Thickness for Gasket of Bearing Seat	0.1,0.2,0.5
	Fitting Diameter of Flange and Oil Seal	69.95-70
	Spline Clearance of Flange and Driving Pinion (Shaft)	0.036-0.067
	Gear Backlash of Driving Pinion and Gear Ring	0.20-0.30
	Preload of Driving Pinion	2.5-3.5(N·m)
	Back Swing of Gear Ring	0.25-0.38
	Tightening Torque of Bolt for Fixing Gear Ring	100-150(N·m)
	Tightening Torque of Bolt for Fixing Speed Differential	100-150(N·m)
	Thickness for Gasket of Planetary Gear	1.562-1.613
	Gear Backlash of Coupling Half Shaft Gear and Half Shaft Spline	0.038-0.130
Axle Housing	Tightening Torque of Bolt for Fixing Axle Housing and Main Reducer Casing	150-175(N·m)
	Fitting Diameter for Small Bearings at Both Ends of Axle Housing (Fig 4-1 Mat 6 or Fig 4-2 S/N 6)	89.66-89.88
	Fitting Diameter of Oil Seals at Both Ends of Axle Housing and Axle Housing	109.913-110
	Tightening Torque of Bolt for Fixing Axle Housing and Frame	630-946(N·m)
	Tightening Torque of Bolt for Brake Bottom Plate and Axle Housing	280-330(N·m)
	Fitting Diameter of Axle Housing and Mast	189.2-190
Wheel Hub	Fitting Diameter of Wheel Hub and Small Bearing	159.32-159.72
	Fitting Diameter of Wheel Hub and Large Bearing	179.32-179.72
	Fitting Diameter of Wheel Hub and Oil Seal	164.6-165
	Tightening Torque of Bolt for Fixing Brake Drum and Wheel Hub	280-330(N·m)
	Tightening Torque of Bolt for Fixing Wheel Hub and Planetary Gear Bracket	98-113(N·m)
	Tightening Torque for Nut Wheel Hub	480-560(N·m)

5. Brake System (Refer to Table 5-1 for main parameters.)

Table 5-1

Item \ Forklift Truck Model			FD50, 60, 70		FD80,100
			Homemade Engine	Imported Engine	
Wheel Brake	Braking Type		Vacuum Power	Power Brake	
	Brake Type		Front Wheel, Internal Expanding Type, and Shoe Brake		
	Inner Diameter of Brake Drum mm		Φ317.5		Φ438.15
	Inner Diameter of Wheel Cylinder mm		Φ31.75		Φ47.62
	Shoe Dimension (L×W×T) mm		324×100×10		489×100×12.7
	Shoe Surface Area cm^2		4×324		4×489
Parking Brake	Type		Mounted on Intermediate Shaft of Transmission, Mechanical, and Internal Expanding Type		
	Inner Diameter of Brake Drum		Φ160		
	Shoe Dimension (L×W×T) mm		140×36×3.5		
	Shoe Surface Area cm^2		50.4		
Brake Pump and Valve	Brake Master Cylinder mm		Φ31.75	/	
	Diameter of Vacuum Booster Front Case/Rear Case		Φ9”/Φ10”	/	
	Brake Valve	Type: Main Valve/Safety Valve		Open Core Type/ Close Core Type	
		Movement Type		Spring Type	
		Inlet Flow Rate 1/min	/	27	
		Max Operating Oil Pressure MPa	/	10.5	
Energy Accumulator	Type		/	Spring Type	
	Capacity		/	66.7	
	Piston Diameter × Stroke		/	Φ50×34	
	Oil Pressure: At Maximum/ At Work MPa		/	7.2/4.9	
	Overflow Oil Pressure		/	13	

5.1 Overview

Brake system is composed of the two parts including wheel brake and parking brake. The wheel brake is installed inside the driving wheel, while the parking brake is mounted on one intermediate shaft at the rear side of transmission.

Wheel brake includes power brake and vacuum power brake in terms of braking patterns.

5.2 Power Brake (Refer to Fig 5-1 for the schematic drawing of the system)

The wheel brake system using power brake method is composed of brake pedal, energy accumulator of brake valve, and brake.

The pressure oil transmitted by pinion pump specially set for the hydraulic system of forklift truck is utilized for power brake. One circuit of pressure oil enters into the brake valve, and enters into the brake wheel cylinder of the brake for brake to be generated, while the other circuit of pressure oil enters into the energy accumulator, for energy to be stored, as standby. Both circuits are controlled by the stroke of brake pedal.

5.2.1 Brake Pedal Device (Refer to Fig 5-2.)

The brake pedal and the inching pedal are mounted on the left side of truck frame through a bracket. The brake pedal located on the right side pushes the piston assembly of brake valve through connecting rod, for the pedal to take control over the pressure oil, while the inching pedal located on the left side plays a linkage function with the brake pedal on the right side, able to control the brake valve in a similar way, and also able to control the inching valve of the transmission at the same time.

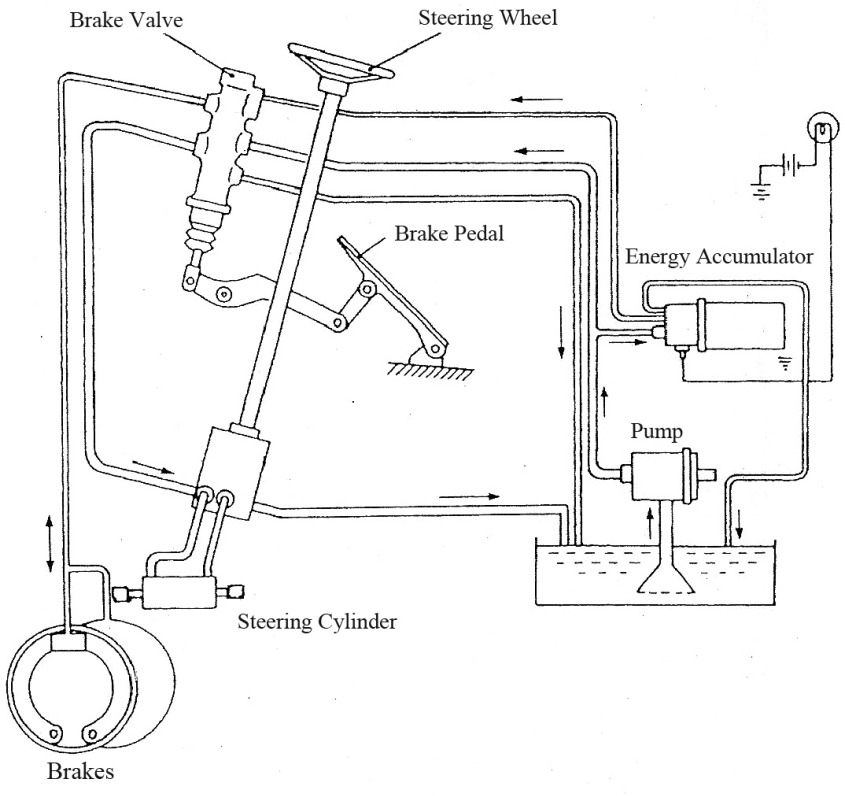
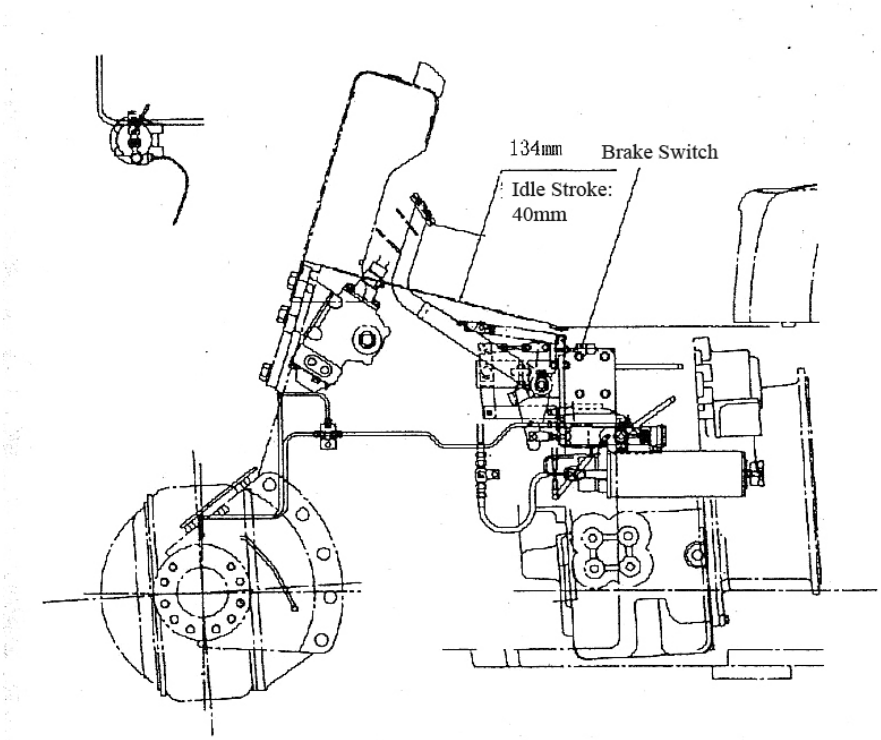


Fig 5-1 Brake System


134mm
Brake Switch
Idle Stroke:
40mm

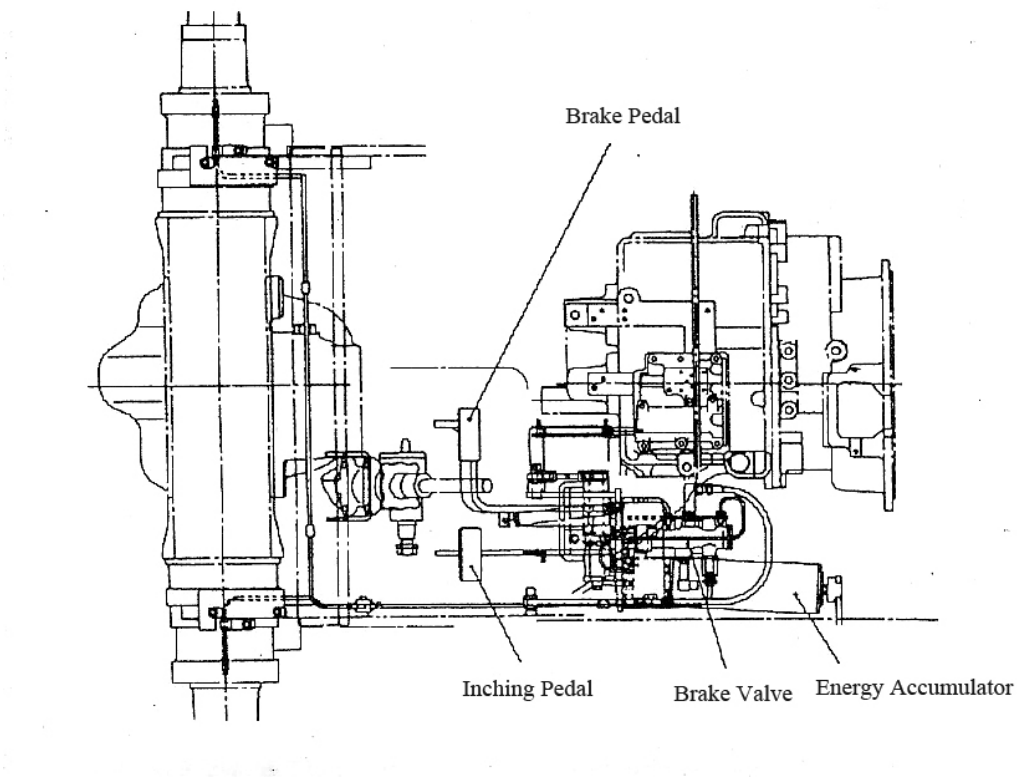


Fig 5-2 Brake Pedal Device

5.2.2 Brake Valve (Refer to Fig 5-3.)

(1) Non-Braking Status

Under the working condition when brake is not performed, as the Opening A of brake valve is opened, the pump joint is interlinked with the joint of steering unit, and steering is in normal service: When brake pedal is not pushed down, it will not generate brake even if steering is operated. At this point, the oil pressure in oil pressure chamber D under control will not rise, as B Opening is closed.

(2) Commencement and Completion of Brake Working Condition

A. When brake pedal is pushed down, the piston assembly 10 moves leftwards, and the valve sleeve 7 and the recoil piston 5 are pressed towards the left side by spring unit, while the return spring 6 is compressed towards left side at the same time along with.

B. Due to the movement of part 7, place A is closed, and D and the joint of oil tank are disconnected. B will be opened accordingly, for D chamber and the pump joint to be interlinked.

C. At this point the valve sleeve 7 moves further leftwards, place C allows the oil pressure of pump joint and D chamber to rise due to compression, namely the oil pressure leading to brake wheel cylinder will rise as well along with, at the same time the relatively higher oil pressure in D chamber will push the recoil piston 5 rightwards, and this thrust force and the pedal force are mutually balanced.

D. When maximum pedal force is entered on the right end of piston, bolt and pedal bracket are used for limitation, in order not for the oil pressure in D chamber to exceed the maximum adjusting oil pressure.

E. Release the foot from the pedal, the counterforce of recoil piston as well as the spring counter forces of parts 6 and 8 will reset the valve sleeve 7 to its original position, and the braking process is completed.

(3) Energy Accumulator Working Process

When oil pump stops work (for flameout of engine) or is damaged, it is required for energy accumulator to enter into the working status.

A. When brake pedal is further pushed down, the valve sleeve 7, the recoil piston 5, and the one-way valve contact pin 3 will move together leftwards, the contact pin will eject the ball, and at this point D chamber and the joint of energy accumulator are connected, to play a braking function to the brake wheel cylinder by using the pressure oil of energy accumulator .

B. Release the foot from the pedal, the valve sleeve, the recoil piston, and the contact pin will move rightwards at the same time, the ball of one-way valve will recover its connection with valve seat (one-way valve closed) under the action of spring force, while the contact pin shall stop at this position.

C. Recoil piston moves rightwards, and the place C is opened, for the oil of brake wheel cylinder of the brake to return to oil tank through D chamber.

5.2.3 Energy Accumulator (Refer to Fig 5-4.)

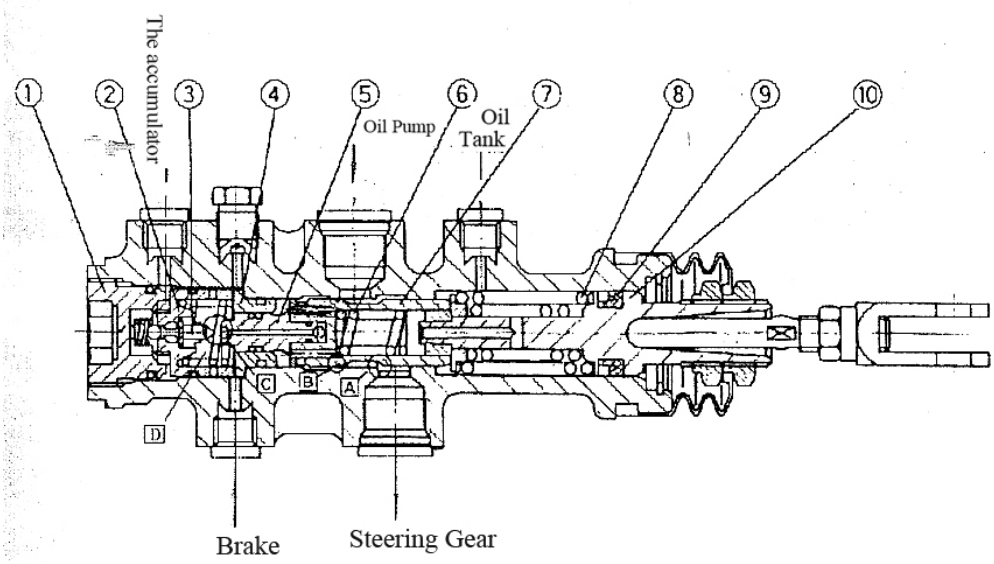
When engine stops work or oil pump has encountered a failure, the energy accumulator may be used as a special energy source, to meet the braking requirement. The energy accumulator is in a spring type.

The graphic representation is a non-accumulating status, and the buzzer of warning switch is under the normally on status.

When brake pedal is operated, and oil pressure has reached more than 3.9MPa, the one-way valve opens and runs oil towards energy accumulator, to push the piston to move leftward and compress the combination spring for oil pressure to be created.

At the same time the leftward movement of piston allows the switch control rod in the place of warning switch to move leftwards under the action of spring pressure, for the switch valve core to fall in the place where the groove of switch control rod is located, and at this point the warning switch is under the off status.

Along with the rise in oil pressure of pump, the stroke for leftward movement of piston is limited by the stop tube in the middle part of combination spring. At this point the energy accumulator stores up the maximum energy, with an oil pressure of 13MPa, and this value is controlled by safety valve.



1. Screw Plug
2. One-way Valve Seat
3. One-way Valve Contact Pin
4. Recoil Piston Guide Seat
5. Recoil piston
6. Return Spring
7. Valve Sleeve
8. Spring Set
9. seal
10. Piston Assembly

Fig 5-3 Brake Valve

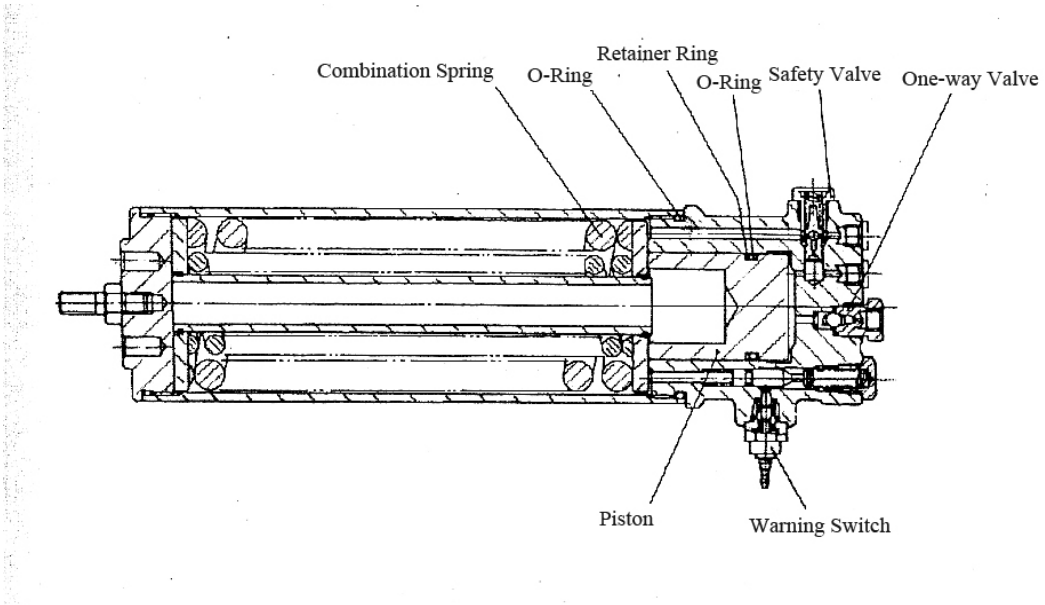


Fig 5-4 Energy Accumulator

5.3 Vacuum Power Brake

5-7t Vacuum power brake, namely vacuum booster with brake master cylinder assembly is applied to the forklift trucks equipped with homemade engines, to achieve assist brake.

Vacuum degree (negative pressure) is utilized as power with vacuum booster (namely utilization of pressure difference between vacuum pressure and atmospheric pressure), for the operators to be able to achieve a relatively high brake wheel cylinder oil pressure, under the action of a relatively light brake pedal force, to play a power-assisting and labor-saving function, which has alleviated the driver's labor intensity and enhanced the safety of wheel brake.

Refer to Table 5-2 for main performance parameters.

Table 5-2

Name		Calculation Unit	Numerical Value
Effective Diameter of Vacuum Cylinder	Max	mm	Φ263
	Min	mm	Φ236
Max Stroke of Vacuum Booster		mm	39
Boost Ratio			7
Brake Master Cylinder	Diameter	mm	Φ31.75
	Max Stroke	mm	38
	Front-Cavity Displacement	ml	15.8
	Rear-Cavity Displacement	ml	14.2
Assembly Max Outer Diameter		mm	Φ272
Size of Mounting Plate		mm	60×80,4-M8 Hole
Size of Oil Outlet		mm	2-M10×1
Deadweight		kg	5.3

5.3.1 Vacuum Booster and Brake Master Cylinder

Refer to Fig 5-5 for the outside drawing and Fig 5-6 for the internal structure of 9”+10” double-diaphragm vacuum booster and brake master cylinder used for 5-7t forklift trucks, and the operating status of the assembly is briefly described as follows:

(1)Non-Working Status

When vacuum booster is under non-working status, the tapered large spring 3 will push the control valve push rod 1 together with the control valve piston 5 to the limiting position on the rear end, while the control air valve 4 is pressed tightly on part 5 by tapered small spring, thus to close the air valve port. At this point, both front and rear cavities of power-assisted air chamber are interlinked through the passage and the control valve cavity with passage B, and cut off from atmosphere. When engine and vacuum pump work, certain vacuum degrees are available in both front and rear cavities of power-assisted air chamber.

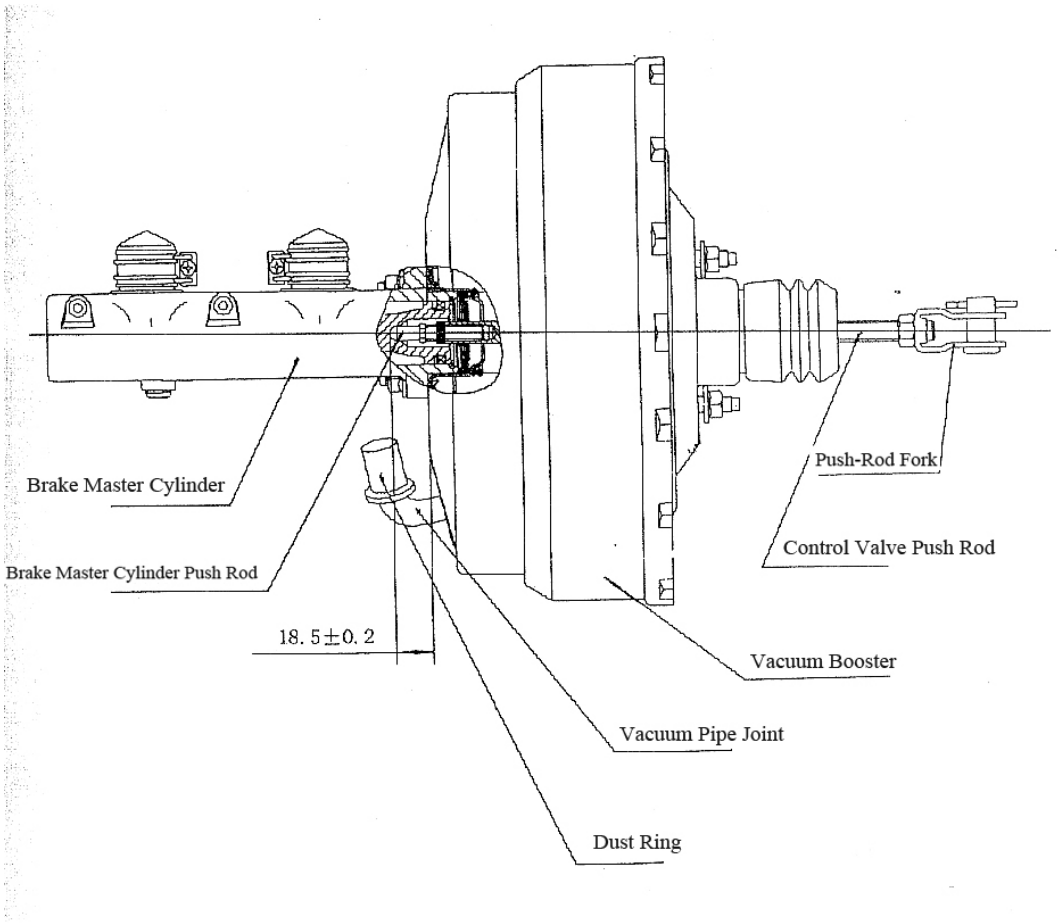


Fig 5-5 Outside Drawing of Vacuum Booster and Brake Master Cylinder

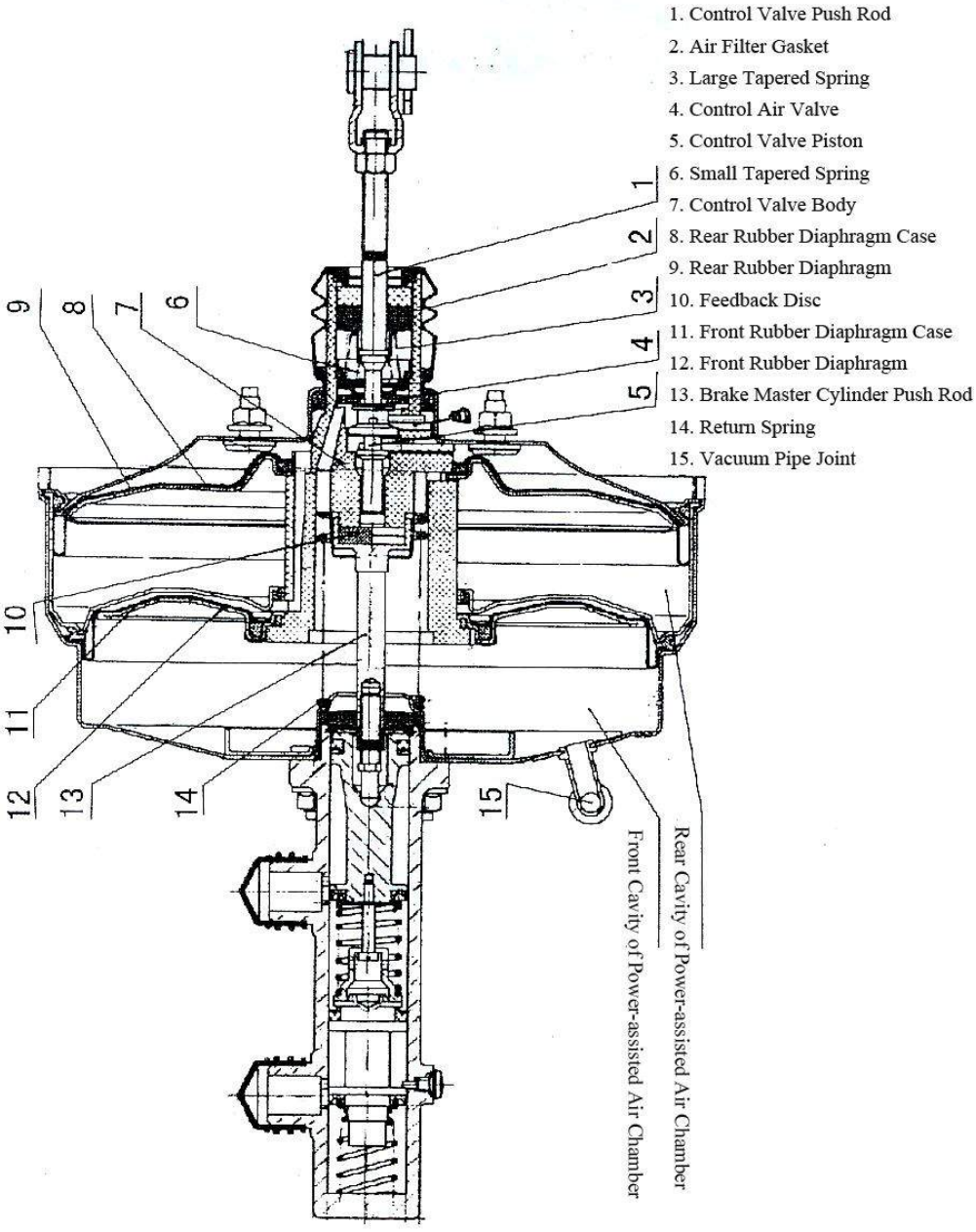


Fig 5-6 Structural Drawing for Vacuum Booster and Brake Master Cylinder

(2)Brake Working Status

A. When brake pedal is just pushed down, the pedal force acts on the control valve stem 1 through lever amplification, and compresses part 3, to move forward together with part 5. Through action of the feedback disc 10 and the master cylinder push rod 13, certain pressure is generated inside the brake master cylinder and transmitted to the brake wheel cylinder inside the brake wheel, and at the same time, the control air valve 4 moves forward with part 5 under the action of small tapered spring 6, to get contact with the port of vacuum valve on the control valve body 7, and close it, for the two front and rear cavities of power-assisted air chamber to be separated from each other (namely the rear cavity of power-assisted air chamber is disconnected with the vacuum source.).

B. Along with the further forward movement of the control valve push rod 1, the control valve piston 5 leaves the part 4, and the external atmosphere is filled into the rear cavity of power-assisted air chamber through the air filter gasket as well as the control valve cavity and the passage B, thus most of the forward acting force caused by air pressure difference in the two cavities of power-assisted air chamber is effected on the feedback disc, and transmitted to the brake master cylinder, to play the power assisting function, through the control valve body 7, except a small part of the action force used for balancing the action force of the large tapered spring 3.

3. Brake Process Termination, and Recovery to Non-Working Status

A. In the process when brake pedal is pushed (namely the forward movement of the control valve push rod), air continuously enters into the front and rear cavities of power-assisted air chamber through the opened air valve port, and the control valve body keeps moving forward. When brake pedal stops being pushed and stays at certain position, the control valve body also moves forward and stops at the position where the air valve port is closed. At this point, the vacuum valve port and the air valve port are both closed, the booster is under the balanced status, namely a balanced status is maintained among the three including the air pressure difference between the front and rear cavities of power-assisted air chamber, the pressure of oil pressure for brake master cylinder, and the thrust of the control valve push rod, and the wheel brake is under the braked status.

B. When brake pedal is released, the control valve push rod 1 and the control valve piston 5 are immediately pushed rearwards under the effect of return spring 14 and large tapered spring 3, for the control air valve 4 to be disengaged from the vacuum pump port, and then a braking process is completed, and it recovers to the original non-working status.

5.3.2 Method for Installation of Vacuum Booster and Brake Master Cylinder Assembly

(1)Connect the 4-M8 bolts for the booster with the mounting bracket and mount it on the frame of forklift truck. Connect the adjusting fork on the end part of booster with the connecting rod of brake pedal. Then tighten the 4-M8 bolts, at a tightening torque of 12N.m-18N.m.

(2)Connect the vacuum hose onto the joint of vacuum pipe for the booster, and keep it sealed.

(3)Connect the brake oil pipe with the 2-M10x1 thread for the oil outlet of brake master cylinder, at a tightening torque of 12 N·m-18 N·m.

(4)Open the turning lid of liquid storage room, and inject the brake fluid (not to be blended with dust or impurity). Exhaust the air inside the entire brake system.

(5) The tightening torque is 12 N·m-16 N·m for the connecting nuts between the brake master cylinder and the vacuum booster, when brake master cylinder or vacuum booster is separately replaced.

(6) Please never randomly adjust the push rod head on the fitting face of vacuum booster and brake master cylinder.

5.3.3 User Notices

(1) Brake fluid specified in this operation manual must be used for this product.

(2) Air in the pipeline must be fully exhausted, after this assembly is added with brake fluid.

(3) Observe that the liquid level of liquid storage tank shall be at the middle position, after air exhaust is completed.

(4) Any of the failures and effects listed in Table 5-3 shall be repaired by qualified professionals.

5.3.4 Failure and Cause Analysis – Refer to Table 5-3.

Table 5-3

Failure and Effect	Cause Analysis
No Oil Pressure for Two Cavities or Any Cavity of Master Cylinder Created, Represented in a Sudden Enlargement in Pedal Stroke	1. Rubber Ring of Master Cylinder Worn out 2. Oil Outlet Pipeline Damaged
Output Oil Pressure not Large, while Pedal Force Turned to be Heavy	1. Vacuum of Booster Leaked 2. Engine Vacuum Pipeline Leaked
Frequent Oil Starvation for Oil Reservoir	1. Joint Area of Cylinder Leaked 2. 1st Piston Rubber Ring of Master Cylinder Worn out
Brake Pedal Low and Soft	1. Air Present in Oil Circuit System 2. Clearance between Booster Push Rod and Master Cylinder Piston too Large

5.4 Wheel Brake

The 5-7t wheel brake is an internal expanding and shoe brake, one for left and right symmetrically, respectively installed inside the two driving wheels. The brake is composed of one pair of brake shoe assemblies (one as primary and secondary brake shoes, respectively), brake wheel cylinder (one for 5-7t), one clearance adjuster, 3-4 return springs, and the bottom plate of brake. The outside of the brake shoe is riveted with a friction plate, and the clearance adjuster is used to adjust the clearance between the friction plate of brake shoe and the inner wall of brake drum.

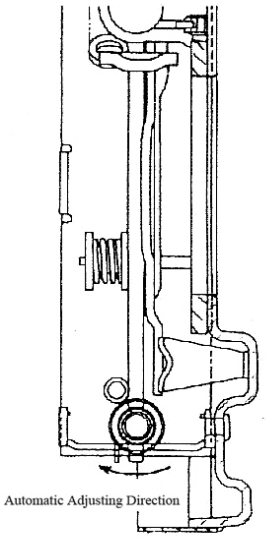


Fig 5-7

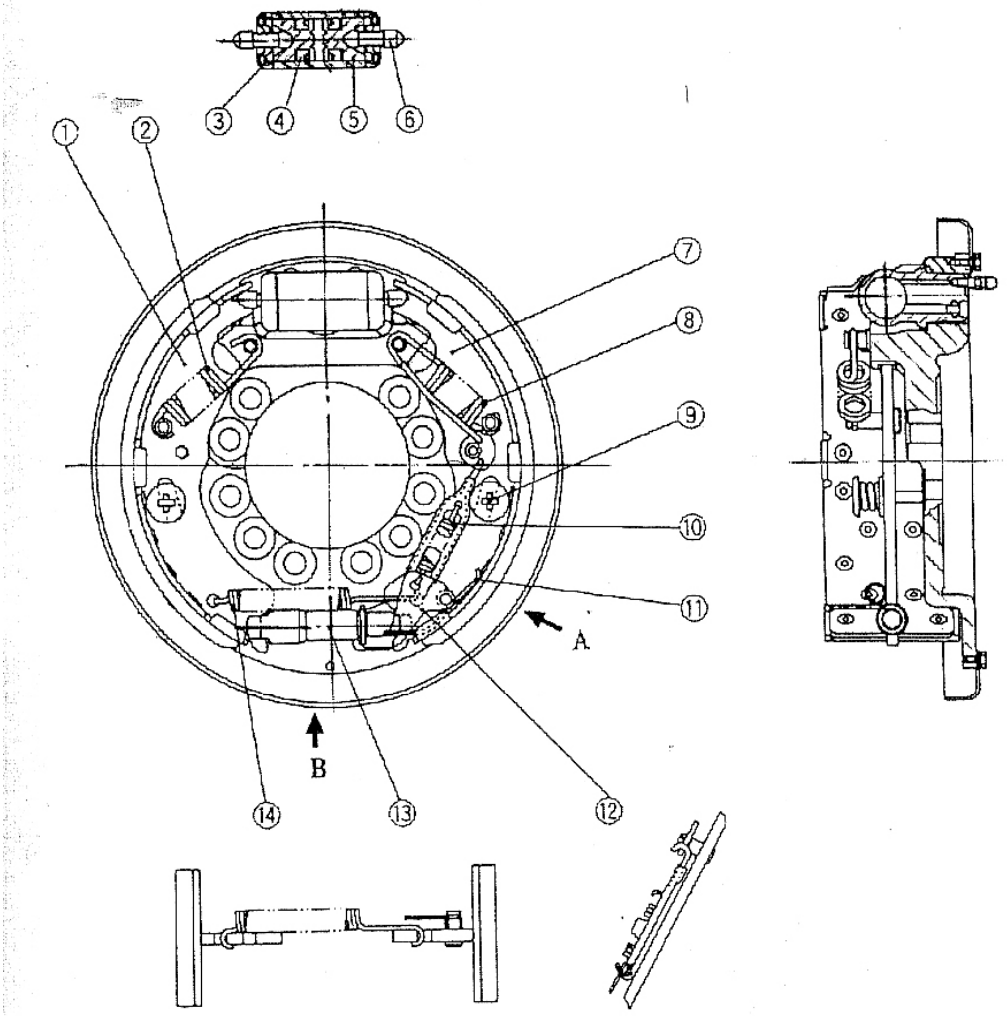
The 8-10t brake is a clamping brake, with brake calipers symmetrically mounted on the outer edge of the brake disc. Piston pushes the brake block under hydraulic action, to bear down on the brake disc during brake, for brake moment to be generated. After the brake pressure is eliminated, the piston resets to the original position under the effect of return spring tension.

5.4.1 Wheel Brake (For 5-7t Trucks) (Refer to Fig 5-8.)

The wheel brake for 5-7t trucks only has one brake wheel cylinder and the two ends of its piston rod contact the upper ends of the primary and secondary brake shoes, respectively. The lower ends of the primary and secondary brake shoes are in mutual contact with the two ends of clearance adjuster, and pressed on the brake bottom plate by spring and pressure spring.

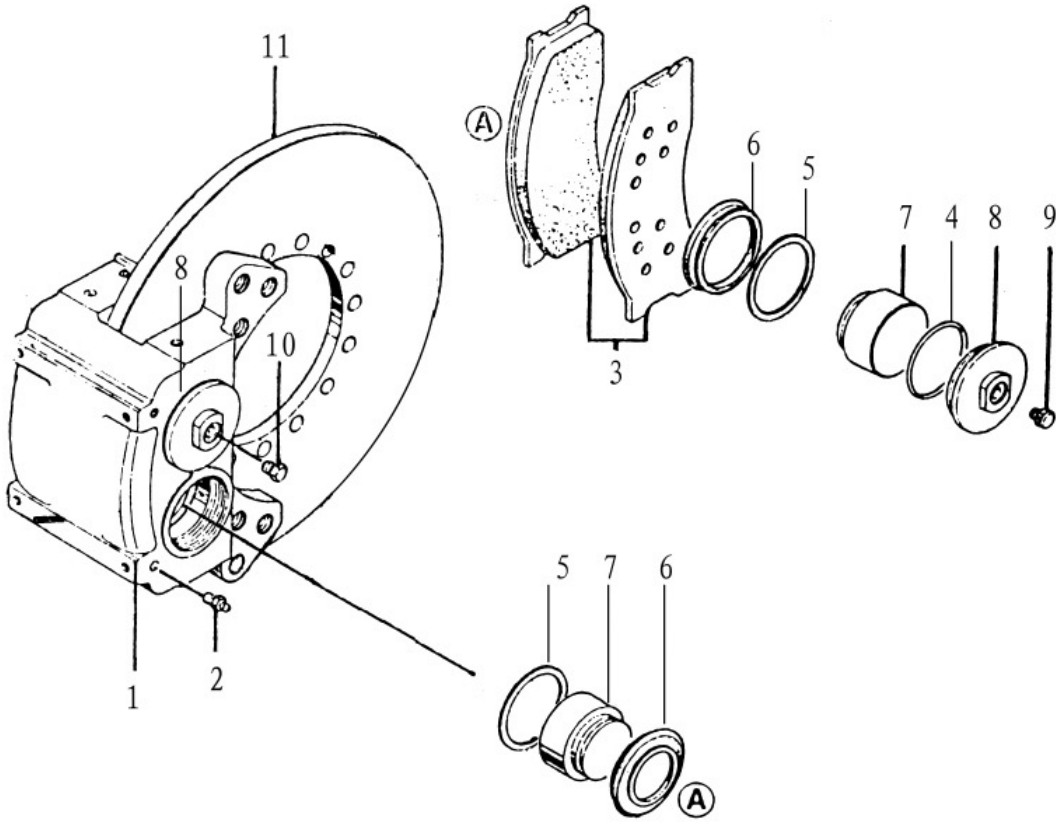
The automatic clearance adjusting device takes effect during backward brake of forklift truck in general, namely the adjusting lever automatically turn the gear on the adjuster by one tooth, when clearance is big, for the clearance to be maintained at 0.4-0.6mm after adjustment. Refer to Fig 5-7 for the turning direction during gear adjustment.

As there are two forms of 5-7t wheel brake, there are two types of materials used for rubber cups of brake wheel cylinder: namely oil-resisting rubber is used for the rubber cup in the form of power brake, while the rubber cup for the vacuum power form is made of leather or synthetic leather. Double attention shall be paid during replacement of parts.



1. Primary Brake Shoe	6. Push Rod	11. Adjuster Spring
2. Return Spring	7. Secondary Brake Shoe	12. Adjusting Lever
3. Dust Ring	8. Return Spring	13. Adjuster
4. Rubber Cup	9. Shoe Fixed Pin	14. Return Spring
5. Piston	10. Spring with Pretightening Force	

Fig 5-8 Brake (5-7t)



1. Clamping Brake Caliper Body
2. Deflating Valve
3. Friction Block Assembly
4. O-Ring
5. Rectangular Seal Ring
6. Dust Ring
7. Piston
8. Inlet Oil Sealed Pump Cover
   Oil Seal Wheel Cylinder Head
9. Hole Plug
10. Screw Plug
11. Brake Disc

Fig 5-9 Clamping Brake (8-10t)

5.4.2 Wheel Brake (For 8-10t Trucks) (Refer to Fig 5-9.)

Clamping brake is used as the wheel brake for 8-10t forklift trucks. The brake disc is fixed on wheel hub using screws, as the rotating component. The brake calipers are symmetrically installed on the outer edge of brake disc, and the brake calipers are composed of inner caliper housing and outer caliper housing, with inner and outer caliper housings fixed into a whole using bolts, after being assembled together, to form the brake block. The brake block is suspended and installed on the caliper housing through guide pin and is able to make axial movement along the guide pin. The inner and outer caliper housings on the two sides are actually a hydraulic brake wheel cylinder block, respectively, wherein one piston is mounted, respectively, and rectangular section rubber seal rings are fitted on the wall of brake wheel cylinders. The inner cavities of the two cylinders are joined using the oil pipe located outside the housing. Spring is fitted inside the cavity of piston, as a mechanism for automatic return and automatic compensation for wear of friction plate. The fixed pin shaft is screwed down on the caliper housing, and the friction snap ring is mounted on the pin shaft with certain frictional force. One end of return spring is supported on the outer flange of sleeve, while the other end is pressed on the cover plate, and the cover plate is retained using retainer ring. The sleeve is limited using friction snap ring. During brake, the piston moves under the hydraulic action, the retainer ring on the piston actuates the cover plate to compress the return spring. The piston pushes the brake block, to bear down on the brake disc, for brake moment to be generated. When pressure of brake fluid is eliminated, the piston recovers to its original position under the tension effect of return spring.

After the friction lining is worn out, the displacement of piston during brake is increased, and when the displacement of piston is larger than the clearance between the retainer ring and the sleeve flange, the movement of piston will allow the retainer ring to bear down on the sleeve flange, to force the sleeve to overcome the frictional force between the friction snap ring and the fixed pin shaft, to move together with piston. The travel of the friction snap ring relative to the fixed pin shaft is namely the wear of the lining. After the pressure of brake fluid is eliminated, under the action of return spring, the piston will still move back for a certain distance, the friction snap ring will stop at a new position, thus for the clearance of brake to always maintain a normal value, and as a consequence, to achieve the target for automatic reset of piston and compensation for wear of lining.

5.5 Parking Brake

The parking brake is in an expanding and shoe type, installed at the output end of one intermediate shaft at the rear side of transmission (Refer to Fig 3-1 Sequence 9). Refer to Fig 5-12 for detailed structure.

Refer to Fig 5-11 for operation of parking brake. Under the running status with standard load, for forklift truck to perform parking brake on a ramp, its hand operating force shall not be larger than 300N. The size of pulling force is adjusted in the direction as indicated in the drawing, and B is the point for measurement of force.

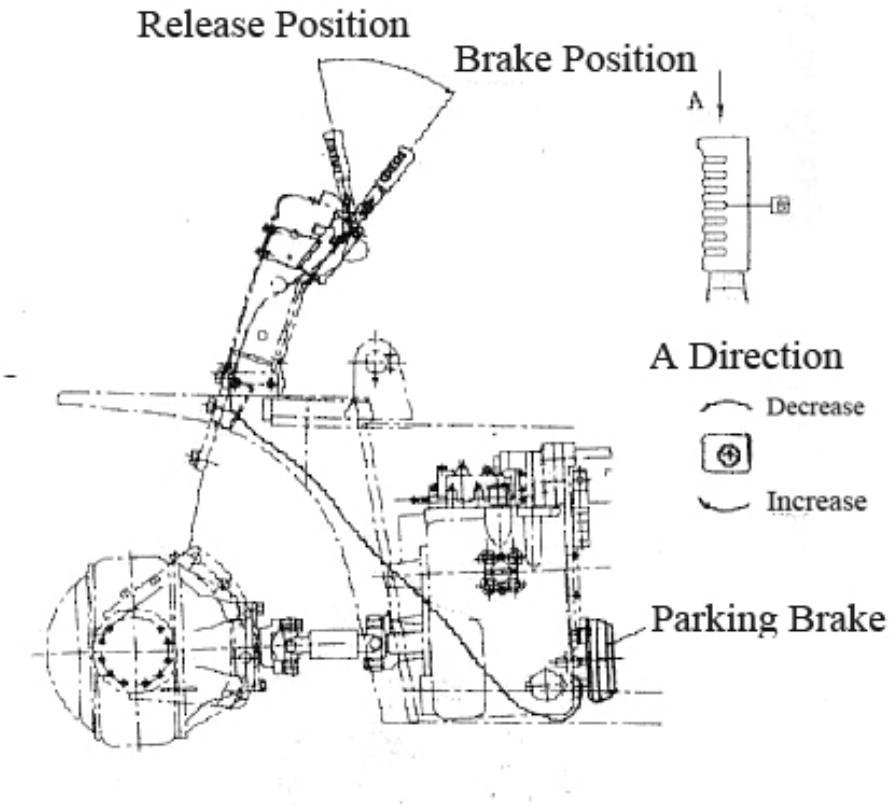
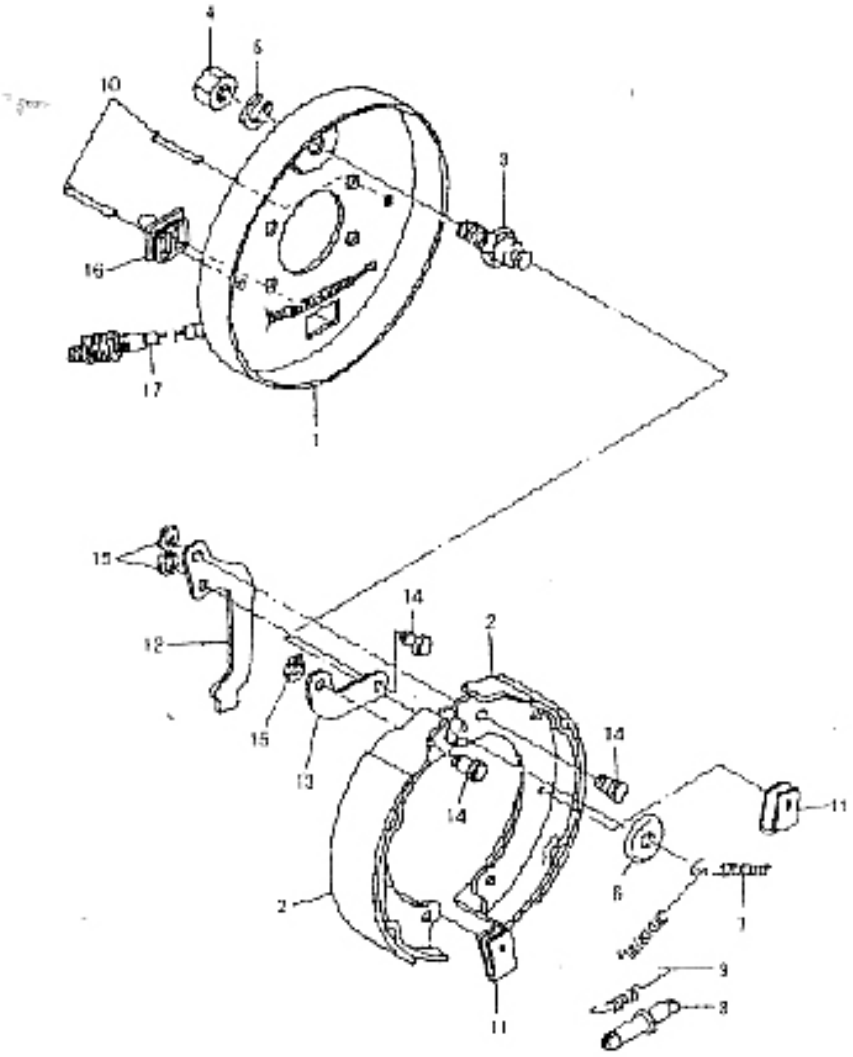


Fig 5-10 Parking Brake Control Device



1.Bottom Plate	7. Return Spring	13. Support Plate
2.Brake Shoe	8. Adjuster	14. Pin
3.Fixed Bolt	9. Adjuster Spring	15. U-Retainer Ring
4.Nut	10. Pin	16. Plug
5.Spring Washer	11. Spring Mounting Bracket	17. Brake Flexible Rope
6.Washer	12. Rod	

Fig 5-11 Parking Brake

5.6 Failure Removal (Refer to Table 5-4.)

Table 5-4

Failure	Cause for Failure Generation	Removal Method
Brake Force Insufficient	Brake Fluid in Brake System Leaked	To be repaired
	Clearance of Friction Plate Misadjusted	To be adjusted
	Brake Over-heated	To be examined as to whether or not brake is skidding
	Contact of Brake Drum and Friction Plate Not Satisfactory	To be adjusted
	Impurity Adhered on Surface of Friction Block	To be repaired or replaced
	Impurity Blended into Brake Fluid	Brake fluid to be replaced
	Brake Pedal Misadjusted	To be adjusted
Noise Present during Brake Work	Surface of Friction Block Hardened or Adhered with Impurity	To be repaired or replaced
	Coupling Bolt Loosened, and Bottom Plate Distorted	To be repaired or replaced
	Friction Block Distorted or Assembly Incorrect after Assembly	To be repaired or replaced
	Friction Plate Partially Worn out	To be replaced
	Wheel Bearing out of Condition	To be replaced
Brake Un-uniform	Surface of Friction Block Adhered with Impurity	To be repaired or replaced
	Action of Wheel Cylinder out of Condition	To be repaired or replaced
	Brake Drum Eccentric	To be repaired or replaced
	Clearance of Friction Plate Misadjusted	To be adjusted
	Charging Pressure for Tyre Unsuitable	To be adjusted
Pedal Weak and Slack	Brake Fluid of Brake System Leaked	To be repaired
	Clearance of Friction Plate Misadjusted	To be adjusted and repaired
	Air Blended into Brake System	Air to be exhausted
	Pedal Misadjusted	To be Readjusted

6. Steering System (Refer to Table 6-1 for main parameters)

Table 6-1

Name of Item \ Parameter / Truck Tonnage		Parameter/Structure		
		5-7t	8t	10t
Type of Steering System		Rear-axle Steering with Power Steering		
Diameter of Steering Wheel mm		360		
Steering Unit	Model	BZZ Portfolio Full Hydraulic Steering Unit		
	Displacement ml/min	280		
	Rated Pressure MPa	16		
Steering Cylinder	Type	Cross Type and Double-Action Type		
	Cylinder Diameter/Rod Diameter mm	Φ115/Φ85		
	Stroke mm	2×216		2×260
Bypass Valve	Set Pressure MPa	12.3		
	Rated Flow Rate 1/min	25		27
Steering Axle	Type	Central Supporting Shaft Supported and Cross Cylinder Type		
	Steering Angle Outer Wheel/Inner Wheel	79°/50°		
	Rear-Wheel Tread mm	1700		
	Steering Knuckle King Pin Spacing mm	1500		
Slewing Diameter of Universal Joint Assembly mm		Φ42		
Wheel	Tyre	8.25-15-14PR	9.00-20-14PR	
	Wheel Rim	6.50-15	7.0-20	
	Air Pressure MPa	830	760	

Steering system is composed of steering wheel, steering pipe column (including steering shaft and locking handle), universal joint assembly, steering unit, steering axle, and steering cylinder. Refer to Fig 6-1 for steering control device.

Steering shaft and steering unit are connected through universal joint. The steering wheel actuates the steering shaft and the universal joint for steering unit to act, so as to achieve hydraulic steering. The steering pipe column that supports the steering shaft is able to tilt forward and backward for a certain angle, for it to be adjusted to a proper position, to meet the requirements of different drivers.

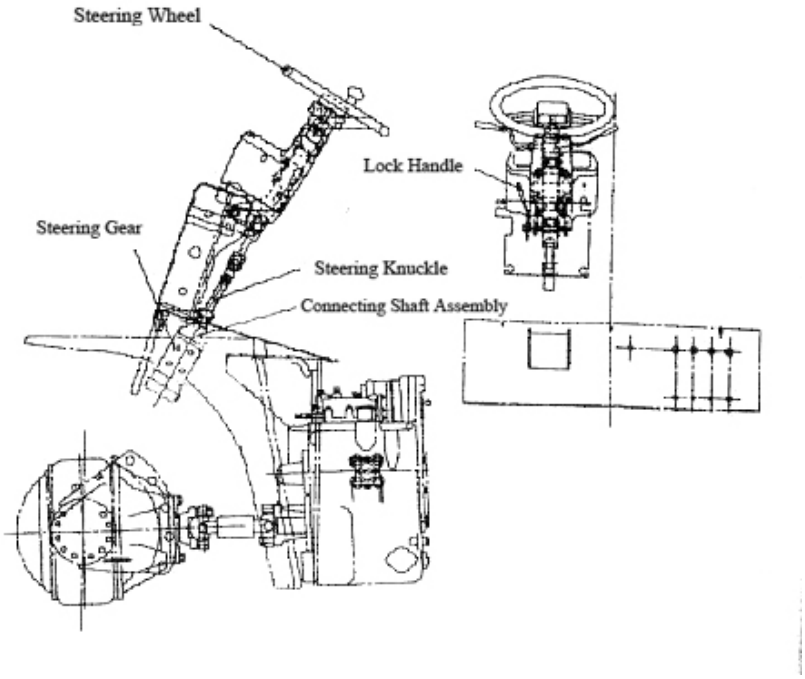


Fig 6-1 Steering Control Device

6.1 Steering Unit

6.1.1 Overview

The steering unit is a cycloid full hydraulic steering unit, able to convey the pressure oil from bypass valve to steering cylinder according to the size of the rotating angle for the steering wheel in a measuring way, to achieve the rear wheel steering. When engine is flamed out, the oil pump is unable to supply oil, and steering may be achieved manually. Refer to Fig 6-2 for the schematic drawing of full hydraulic steering system, and refer to Fig 6-3 for the drawing for the structure of steering unit.

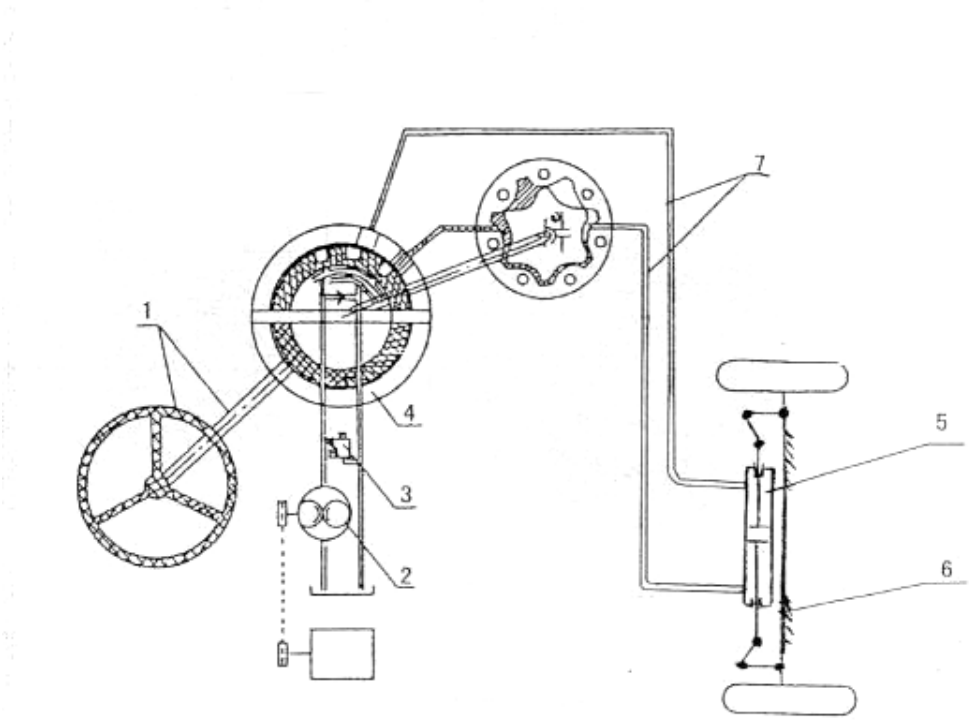


Fig 6-2 Schematic Drawing for Fully Hydraulic Steering System

1. Steering Wheel and Steering Shaft
2. Oil Pump
3. Flow Rate Control Valve
4. Hydraulic Steering Unit
5. Steering Cylinder
6. Steering Axle
7. Flexible Pipe

6.1.2 Operating Principle (Refer to Fig 6-4.)

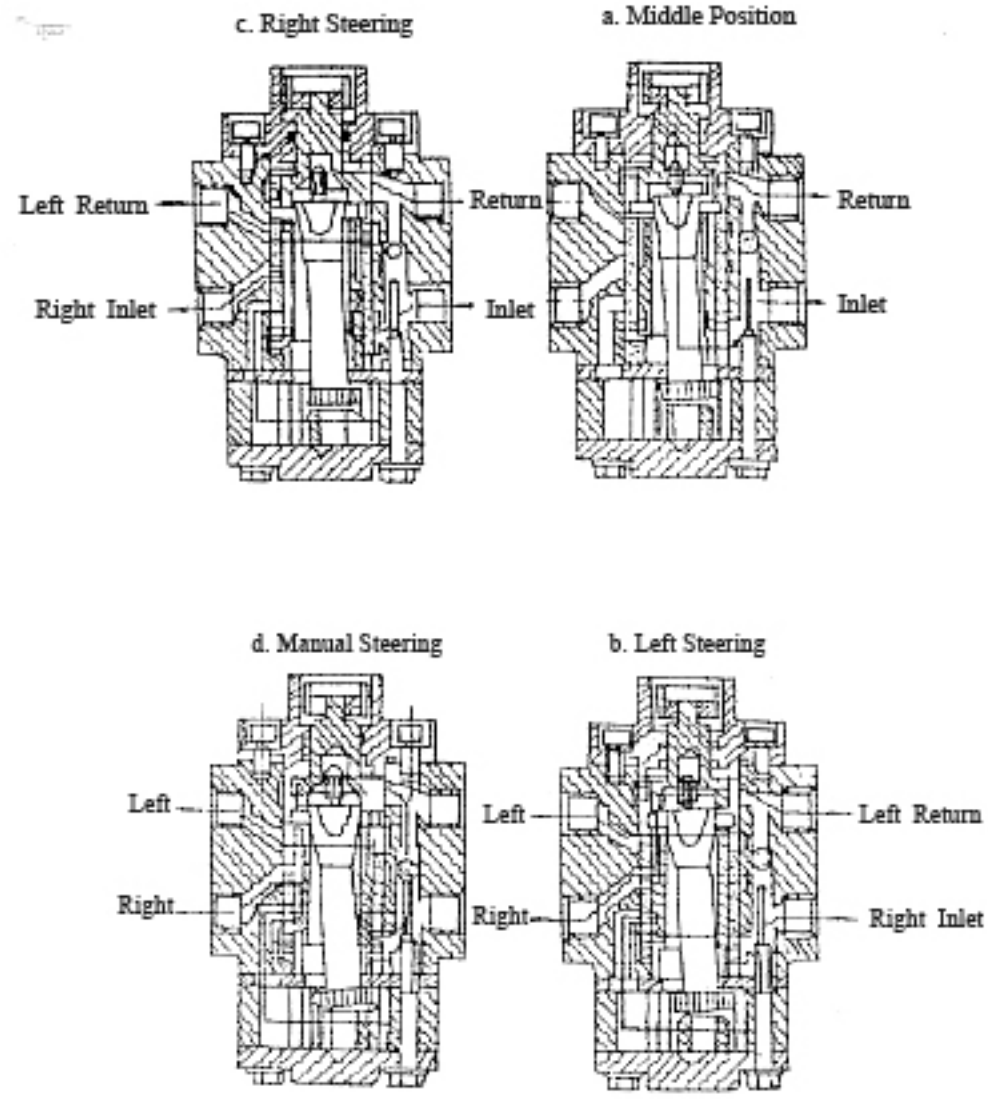


Fig 6-4. Drawing for Oil Circuit of Steering Unit

The valve core, valve sleeve, and valve body in steering unit form the rotary servo valve, to play the function for controlling the oil flow direction. The rotor and stator form the cycloid engagement pair, to play the function for measuring components during power steering, so as to ensure the oil quantity flowing into the cylinder and the turning angle of the steering wheel to be in direct proportion. It plays the function of manual oil pump during manual steering. The universal driving shaft plays the function for transmitting torque.

When it is at the middle position (namely when steering wheel is not turned.), the oil from oil pump returns to oil pipe through valve core in the open-core system (as in Fig 6-4).

During power steering, the oil from oil pump enters into the cycloidal lantern gear engagement pair, and pushes the rotor to rotate following the steering wheel, and presses quantitative oil pressure into the left cavity or the right cavity of cylinder, to drive the steering wheel to achieve power steering, while the oil of the other cavity will return to oil tank (b and c in Fig 6-4).

When engine is flamed out, the steering wheel is controlled depending on manual force, to drive the rotor through valve core, poking pin, and universal driving shaft and to press the oil from one cavity of the steering cylinder into the other cavity, through, to drive the steering wheel, so as to achieve manual steering (d in Fig 6-4). Oil is supplied from oil tank through one-way valve for oil supply.

BZZ1-model steering unit used for this forklift truck is an open-core nonreactive type, namely the external force acted on the steering wheel cannot be transmitted to steering wheel. The driver has no road sense.

6.1.3 Application Requirements

(1) Installation

When steering unit is installed, it shall be ensured that it shall be concentric with the connecting shaft assembly on the lower end of universal joint, and axial clearance shall exist, to avoid valve core from being jammed up, and it is required to examine whether or not steering wheel can reset flexibly.

For pipeline installation, the “Inlet” marked at the joint of steering unit shall be connected with the oil pipe from oil pump, while the marked “Return” is to be connected with oil tank, and the marked “Left” and “Right” shall be respectively connected with the left cavity and the right cavity of steering cylinder.

The allowable flow rate for oil suction pipe is 1-1.5m/s, while the allowable flow rate for pressure oil pipe and return oil pipe is 4-5m/s, and the test pressure for high-pressure hose shall not be lower by 1.5 times than the maximum operating pressure.

The section of oil tank position shall be higher than the mounting position of steering unit, and oil suction pipe shall be inserted into the oil level, thus to be able for oil supply during manual steering, and at the same time to be able to avoid blending of air into oil.

To facilitate safety and repair, it is recommended to set a pressure gauge adapter in the place of oil inlet for steering unit, so that the pressure gauge can be installed.

(2)Range of Oil Temperature: -20℃～+80℃

Normal Oil Temperature: +30℃～+60℃

(3)Selection of Oil Used: N46 or N32 Hydraulic Oil

(4)Filtration: The filtration precision for oil liquid into steering unit is 30μm, and it shall be ensured that the return oil of steering unit has a 0.2-0.3MPa back pressure, to prevent backflow of oil into oil tank during manual steering.

(5)All the pipelines in the system shall be cleaned up, and the oil tank shall be closed, to minimize oil pollution.

(6)Test Run: Test Run: Prior to operation oil tank shall be cleaned, and oil shall be injected to the maximum oil level. Loosen the threaded joint for the cylinder, for the oil pump to operate at low speed for air bleed, until the outgoing oil contains no foam anymore.

Remove the connection between piston rod and steering wheel, and turn the steering wheel, for piston to reach the leftmost or the rightmost position (staying to be avoided at the two extreme positions, and then further add oil into the oil tank up to the maximum oil level.

Tighten all the threaded connection places (tightening under pressure to be avoided), connect the piston rod, and examine whether or not the work of steering system is normal under various working conditions. It is required to search for the causes carefully when heavy steering or malfunction is found. It is not allowed to turn the steering wheel forcibly, and moreover to take it apart in a hurry, to prevent the damage of parts for the steering unit.

Examine whether or not the system pressure complies with the specified value, when piston of cylinder reaches the extreme position.

(7)Application Service:

Examine whether or not oil leak exists, and examine the oil level and working status every day. Replace core of filter and oil liquid regularly according to specification. The condition of hydraulic oil may be examined by dropping one drip of oil onto the blotting paper, and it cannot be used any more if there is a black center with oil stain. Causes for anomalies found if any during use shall be carefully searched for, and it is strictly prohibited for two persons to turn the steering wheel at the same time.

6.1.4 Examination and Maintenance of Steering Unit

Steering system must be regularly examined, for it to maintain a good working status, and to be prevented from the occurrence of unexpected accidents.

(1) Regularly examine the water content, mechanical impurity, and acid value of the working oil. The oil shall be replaced with new one when the original brand specification is exceeded, and it is absolutely prohibited to use the used and not filtered waste oil.

(2) It is not allowed to take apart the steering unit in a hurry, when steering system is examined, and the "Notices for Assembly" shall be followed, when it has been confirmed that failure exists with the steering unit.

(3) All the disassembly appliances used shall be cleanly, the site shall be clean, and it is the best for disassembly to be performed indoors.

(4) Notices for Assembly:

a. Clean up all the parts using gasoline or coal oil prior to assembly, and the paint if any on the bonding face shall be wiped up using acetone. It is prohibited to scrub the parts using cotton yarn or rags, while hair brush or silk cloth shall be used, and the parts may be blown off using compressed air where there the condition permits. The rubber ring shall never be soaked in gasoline for a long time. After steering unit has been properly assembled, it is required to add 50-100ml hydraulic oil at the oil inlet port and to turn the valve core leftwards and rightwards before it is assembled on to the truck. The steering unit can only be loaded for test run if no anomaly is found.

b. The bonding faces of valve body, separation disc, stator, and rear cover shall be highly clean, and they can be bruised and scuffed on no account.

c. Pay attention that the screw sleeve must be lover than the plane of valve body.

d. Both retainer ring and slip ring have a beveled side, and the bevel of retainer ring shall face the front cover, while the bevel for slip ring hole shall face the front valve core.

e. Punch point marks are available on the end faces of both rotor and universal driving shaft, and the two points shall face each other during assembly.

f. Copper washer or aluminum washer must be used as the washer for limit bolt (with pin).

g. Fastening method for 7 bolts on the rear cover: Screw one bolt for every other two bolts in sequence, and screw down the bolt gradually instead of in turn, at a tightening torque of 3-40N.m.

h. Pay attention to the "Inlet", "Return", "Left", and "Right" marks for valve body when oil pipe is installed, and the oil pipes shall be accordingly connected with corresponding oil pipes one by one.

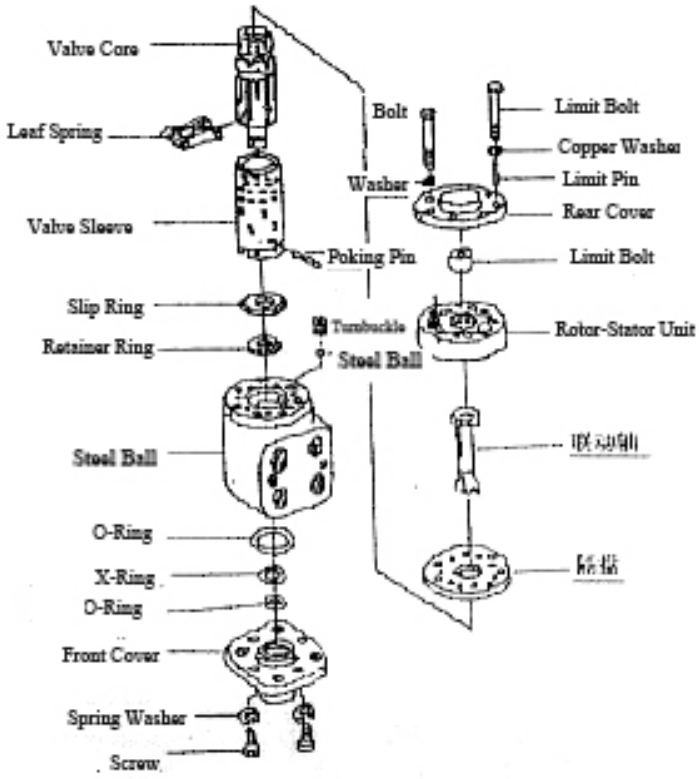


Fig 6-5 Drawing for Disassembly and Assembly of Steering Unit

(5)Disassembly and Assembly (Refer to Fig 6-5.)

a. Sequence of Disassembly: Front Cover – Retainer ring – Slip Ring – Valve Sleeve, etc – (Gasket – Poking Pin – Valve Core – Leaf Spring) – Rear Cover – Limit Column – Stator – Rotor – Universal Driving Shaft – Turnbuckle – Steel Ball – Valve Body

As in the case when disassembly begins with rear cover, the steel ball must be taken out firstly, before the valve core and valve sleeve, etc are extracted, and otherwise it is liable to block and damage the valve body. Moreover, attention shall be paid not to bruise or scuff the other end face of valve body, when front cover is detached.

b. Sequence of Assembly

Valve Core – Leaf Spring – Valve Sleeve – Poking Pin – Valve Body – Slip Ring – Retainer Ring – Front Cover – Steel Ball – Turnbuckle – Separation Disc – Universal Driving Shaft – Rotor – Stator – Limit Column – Rear Cover

6.1.5 Failure and Removal for Steering Unit: Refer to Table 6-2.

Table 6-2

Failure	Cause of Generation	Effect	Removal Method
Oil Leak	Dirt Present on Bonding Face	Oil Leak with Valve Body, Separation Disc, Rotor, and Rear Cover Bonding Face	To be re-cleaned
	Rubber Ring in Shaft Radial Place Damaged, Leading to Oil Leak		Rubber ring to be replaced
	Unsmooth Washer in the Place of Limit Bolt, Leading to Oil Leak		Washer to be grinded smooth or to be replaced
Steering Heavy	Oil Supply for Oil Pump Insufficient	Light for Slow Turn of Steering Wheel, while Heavy for Quick Turn of Steering Wheel	Proper oil pump to be selected or bypass valve of oil pump to be examined as to whether or not it is under normal condition
	Air Present in Steering System	Foam Present in Oil, Giving out Irregular Sound, Steering Wheel Rotates, But Cylinder Stays Still Sometimes	Air in the system to be discharged, and oil suction pipeline to be examined
	Oil Tank not Full		Oil to be added to the specified level height
	Viscosity of Oil Liquid too Thick		Oil liquid of recommended viscosity to be used
	Steel Ball One-way Valve inside Valve Body Invalid	Steering Wheel Heavy for Both Quick Turn and Slow Turn, and Steering without Pressure	Φ8 steel ball to be loaded, if lost, and steel ball to be cleaned if blocked with dirt
	Pressure of Bypass Valve Lower than Working Pressure or Bypass Valve Blocked with Dirt	Light Steering for No Load (or Light Load), while Steering Heavy with Increased Load	Pressure of bypass valve to be adjusted or bypass valve to be cleaned

Table 6-2 Continued

Failure	Cause of Generation	Effect	Removal Method
Steering out of Order	Leaf Spring Broken	Steering wheel fails to return to middle position automatically, and the pressure drop at middle position is increased.	Damaged leaf spring to be replaced
	Poking Pin Broken or Distorted	Pressure oscillation is obviously increased, and the steering wheel even fails to rotate.	Poking pin to be replaced
	Opening of Universal Driving Shaft Broken or Distorted	Pressure oscillation is obviously increased, and the steering wheel even fails to rotate..	Universal driving shaft to be replaced
	Mutual Positions of Rotor and Universal Driving Shaft Misloaded	Oil distribution relationship is in disorder, and the steering wheel rotates by itself or swings leftward or rightward.	To be reassembled according to Notices (e) for Assembly
	Two-way Overload Valve out of Order (Steel Ball Blocked with Dirt or Spring out of Order)	The truck runs out or the cylinder stays motionless, (may possibly move slowly as well) when steering wheel is turned.	Two-way overload valve to be cleaned
Failure of Steering Wheel For Automatic Return to Middle Position	(1)Steering Column and Valve Core Eccentric (2)Axial Jam-up of Valve Core by Steering Column (3)Rotating Resistance for Steering Column too Strong (4)Leaf Spring Broken	The pressure drop at middle position is increased or the steering wheel is not relieved when rotation stops (Vehicle to run out).	To be removed based on cause for failure generation
Manual Steering Not Available	Radial Clearance and axial clearance of rotor and stator too large	During power steering operation, the piston of cylinder is at extreme position, and the driver has an unclear feeling of destination. During manual steering operation, the steering wheel rotates, while the cylinder stays still.	Rotor and stator to be replaced

6.2 Examination after Reassembly of Steering System:

(1) Examine whether or not the hydraulic pipeline is correctly arranged and whether or not the left and right steering is reversely assembled.

(2) Turn the steering wheel leftward and rightward, and turn it thoroughly to the bottom, to observe whether or not force application for the left and the right is uniform and whether or not rotation is smooth.

(3) After steering system has been properly assembled, jack up the steering wheel, for engine to run at idle speed, and then slowly turn the steering wheel leftward and rightward, repeat it for several times, to remove the air in hydraulic pipeline and steering cylinder. Drop the steering wheel, and turn it further for several times. Examine whether or not the sound during its rotation is normal, and it indicates that air has been fully exhausted, if abnormal sound is not hearted. Then run the engine at the fixed idle speed, to raise the oil temperature.

(4) Measure the steering force:

Park the forklift truck on a dry and flat pavement. Use the parking brake, attach the spring balancing device on the edge of steering wheel, to measure the steering force, and this force must be lower than 150N.

(5) In order to measure pressure, use the pressure gauge (15-20MPa), and shut-off valve and the hose are connected as indicated in Fig 6-6.

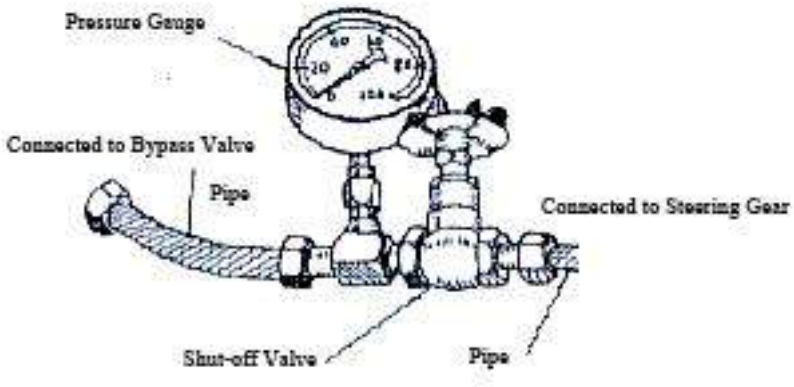


Fig 6-6 Pressure Measurement

Detach the connecting pipe from bypass valve to steering unit. Link up the pipe with pressure gauge on the side close to bypass valve, link up the pipe with shutoff valve on the side close to steering unit, and then allow the engine to run at idle speed.

When steering wheel is under the free status, the oil pressure is about 0.5-2MPa, and if pressure exceeds this value, it is then required to examine whether or not the bypass valve and the pipeline are blocked. Step up the engine speed to about 1500rpm, if no anomaly is found, and then slowly turn off the shutoff valve and pay attention to pressure rise.

The maximum pressure of bypass valve is adjusted to 120MPa, and therefore, when shutoff valve is

fully closed, its set pressure will be indicated on pressure gauge.

It indicates that the bypass valve is out of order, if pressure exceeds 12MPa, but if pressure is too low, it indicates that oil pump is out of order or the spring of bypass valve is broken. Under such circumstances, attention shall be paid not to allow the time for turning off the shutoff valve to exceed 15 seconds.

Attention: Oil pump provides pressure oil to actuate the action of steering cylinder, and its work must be considered from two aspects, namely nominal pressure and rated flow.

Pressure is used to actuate cylinder while flow rate is related to the acting speed of cylinder. On this account, even if pressure is normal, reaching 12MPa, but if flow rate is insufficient, the steering cylinder is still unable for normal work, leading to a heaving steering. Accordingly, when it is required to disassemble and reassemble the bypass valve, the flow and the safety valve shall be properly adjusted according to the capacity and the working condition under which the steering cylinder is used. Fitting mark shall be stamped at the set position, thereby for reassembly to be performed, or the distance of adjusting bolt shall be measured.

6.3 Failure Removal for Steering System

Refer to Table 6-3 for failures and their removal for steering system arisen from bypass valve.

Table 6-3

Failure	Cause for Failure Generation	Removal Method
Steering Wheel Blocked and Stagnated, at Fast-speed Turn	Flow Control Valve Stem Blocked	To be disassembled for repair or for replacement
	Flow Control Valve Stem Worn out	To be wholly replaced
Failure of Oil Pressure to Rise High	Safety Valve Normally Open (Cannot be Closed)	To be wholly replaced
Oil Pressure Higher than Set Pressure of Safety Valve	Safety Valve Normally Close (Cannot be Opened)	To be wholly replaced
Noise Present with Safety Valve	Vibration of Safety Valve	To be wholly replaced
Oil Temperature too High	Safety Valve Normally Close (Cannot be Opened)	To be wholly replaced
Steering Operation Difficult, at Idle Speed of Engine	Safety Valve Normally Open (Cannot be Closed)	To be wholly replaced
	Flow Control Valve Stem Blocked	To be disassembled for repair or for replacement
	Flow Control Valve Stem Worn out	To be wholly replaced
Steering Force Changing	Vibration of Safety Valve	To be wholly replaced
	Flow Control Valve Stem Blocked	To be disassembled for repair or for replacement
	Flow Control Valve Stem Worn out	To be wholly replaced
Steering Operation Difficult	Safety Valve Normally Open (Cannot be Closed)	To be wholly replaced
	Flow Control Valve Stem Blocked	To be disassembled for repair or for replacement
	Flow Control Valve Stem worn out	To be wholly replaced

6.4 Steering Axle

Cross steering cylinder is used for all the 5-10t forklift trucks. Both front part and rear part at the center are supported on the seat of steering axle by two support shafts through lining, while the latter is fixed on vehicle chassis, respectively. The two support shafts are able to swing for a certain angle leftward and rightward. The structures of steering axle for 5-10t forklift trucks are largely identical but with minor differences, and the main structures are indicated in Fig 6-7 and Fig 6-8.

Steering axle is mainly composed of steering axle body, left and right steering knuckle assembly, connecting rod assembly, wheel, and wheel hub, as well as steering cylinder.

6.4.1 Steering Axle Body

The steering axle body is in a sheet steel welded structure. Upper and lower bosses (holes) are available on the two ends for the left and right steering knuckle assembly and the axle body to be connected using steering king pin. The opening size for the bosses of 5-8t forklift trucks is small, while that for 10t forklift truck is large.

6.4.2 Left-Right Steering Knuckle Assembly

The left and right steering knuckle assembly is supported on wheel hub through two thrust bearings, and wheel is mounted on wheel hub. Oil seal is fitted on wheel hub, to prevent overflow of lubricating grease. Plane thrust bearing is fitted between the steering knuckles and the upper and lower bosses of steering axle body, while shim at the underside is able to adjust the rolling clearance. The inner holes of upper and lower bosses are fitted with steering king pins and supported with upper and lower needle roller bearings, while oil seal is used at the underside to seal it up. The upper-end cover is mounted with oil nozzle to lubricate all the bearings through inner holes of king pins, and users shall add lubricating grease on time. Lock pin is available between the king pins of steering knuckle assembly to fix it.

6.4.3 Wheel Hub

Wheel hub is a ball iron part, and the wheel hubs are different as the tyres of 8-10t forklift trucks are not the same as those of 5-7t forklift trucks.

6.4.4 Steering Cylinder

The steering cylinder crossly mounted between the steering axle body is in a double-action type. The piston rod on the two ends is connected with connecting rod assembly, while the other end of the latter is able to drive the steering knuckle arm for wheel to steer. The both ends of the cylinder are guide sleeves, and steel-backed bearing, baffle plate, seal ring, and dust ring are mounted inside the inner hole of the sleeve in contact with piston rod, while support ring, and O-ring are available outside the sleeve in contact with the inner wall of cylinder barrel, in common use for 5-8t forklift trucks. Refer to Fig 6-9 for the structure.

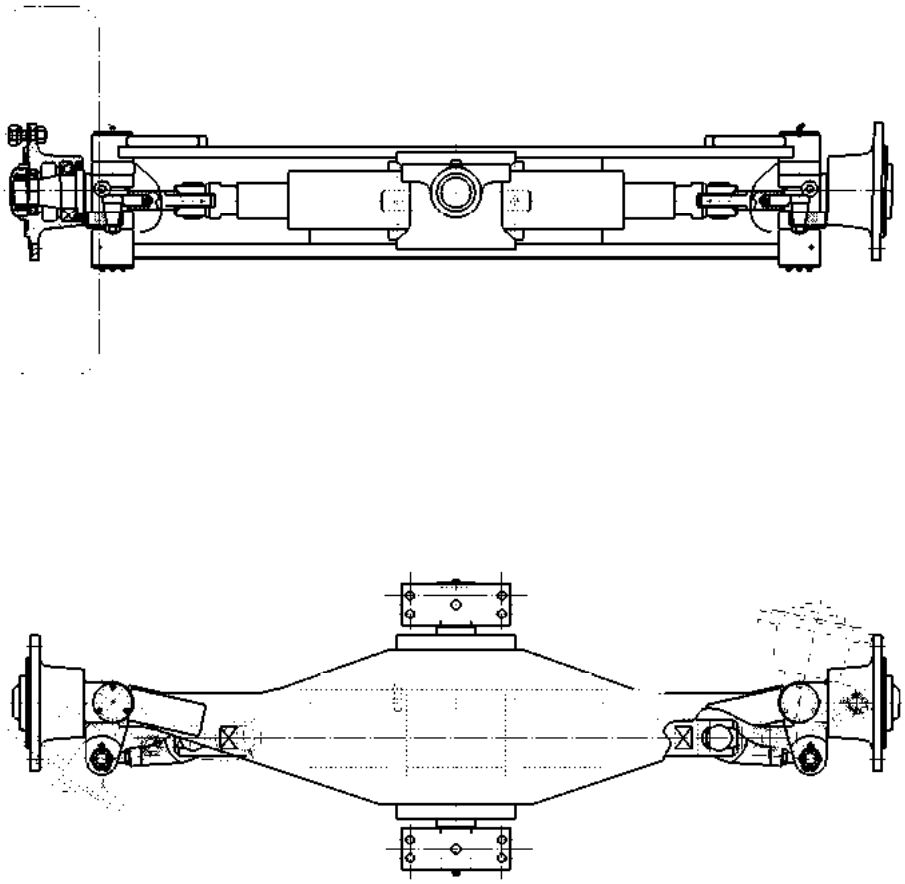


Fig 6-7 Steering Axle

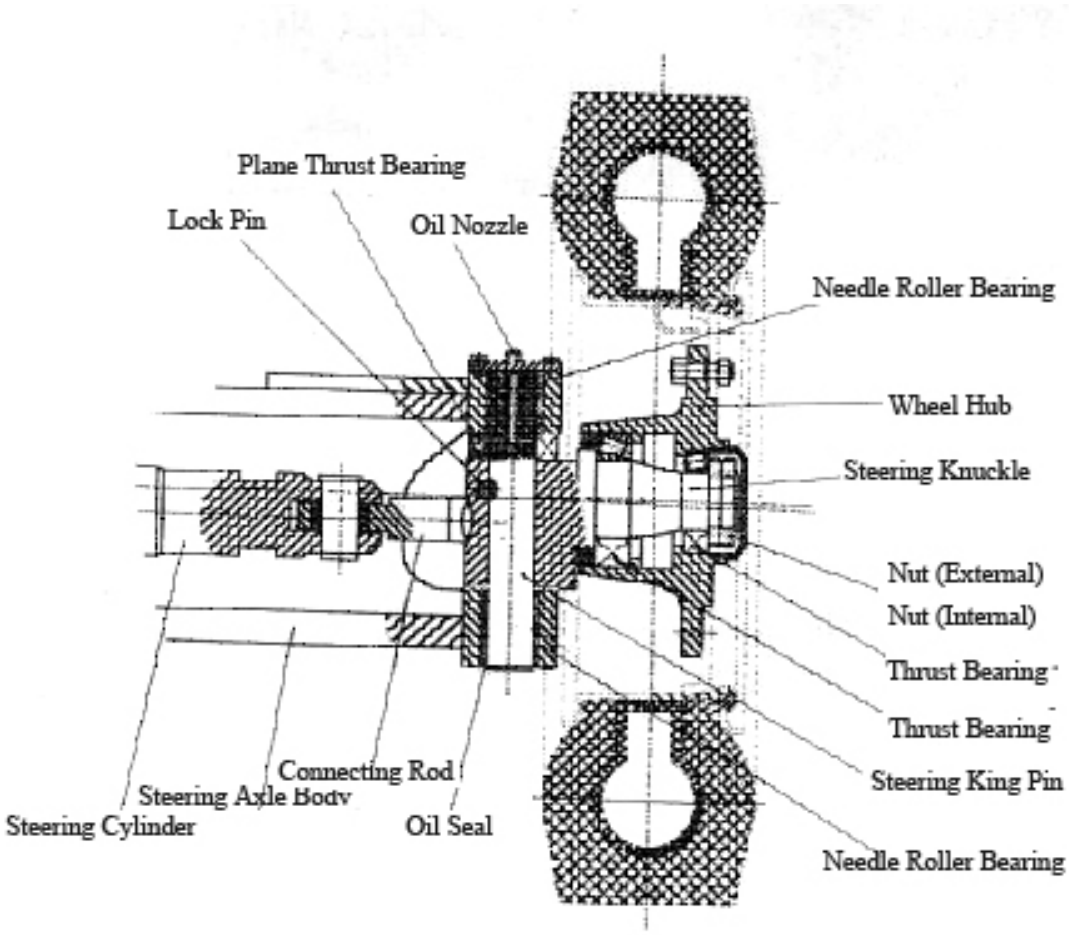


Fig 6-8 Steering Axle

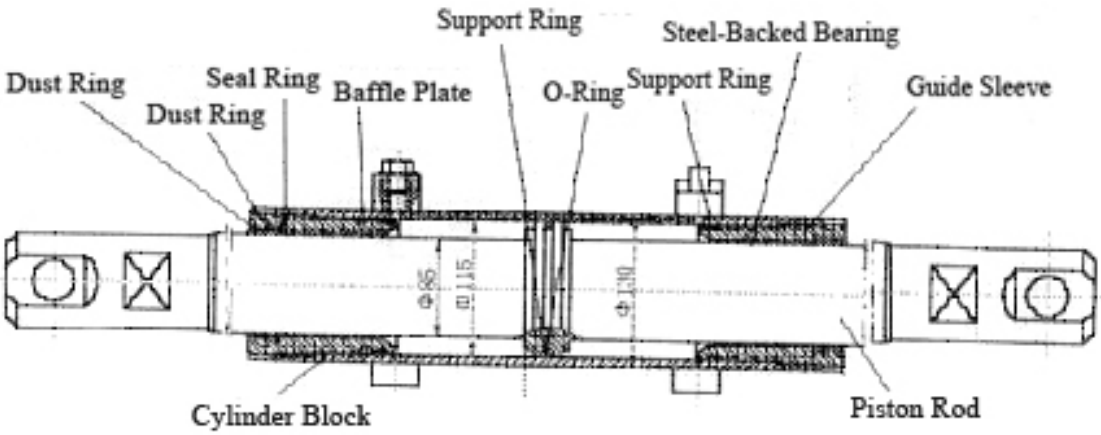


Fig 6-9 Steering Cylinder

7. Hydraulic System

Refer to Table 7-1 for main technical parameters.

Table 7-1

Item \ Truck Tonnage / Brake Type			5-7t		8-10t
			Power Brake	Vacuum Power Brake	Power Brake
Main Oil Pump	Drive Type		Transmission Power Output		
	Rated Pressure		25MPa		
	Front Gear Pump Drawing No	Equipped with Japan 6BG1 Perkins 1104D	CBHY-G36/F3.5-ATΦ Duplicate Pump		CBHY-G36/F3.5-ATΦ Duplicate Pump
		Equipped with Chaochai 6102BG	CBHY-G32/F3.5-ATΦ Duplicate Pump	CBKa-G432-ATΦR	GBHY-G32/F3.5-ATΦ Duplicate Pump
		Equipped with Mitsubishi S6S-T	CBHY-G25/F3.5-ATΦ		
	Rear Gear Pump Drawing No	Equipped with Japan 6BG1 Perkins 1104D	CBKa-G436-ATΦL		CBKa-G436-ATΦL
		Equipped with Chaochai 6102BG	CBKa-G432-ATΦL	CBKa-G432-ATΦL	CBKa-G432-ATΦL
		Equipped with Mitsubishi S6S-T	CBKa-G432-ATΦL		
Multi-way Valve	Type		Double Valve Stem Slide Type (with Safety Valve, Bypass Valve, and Tilt Auto-locking Valve)		
	Set Pressure		20MPa		
	Drawing No	2-Plate Valve	CDB-F20-02		CDB-F20-02
		3-Plate Valve	CDB-F20-03a		CDB-F20-03a
		4-Plate Valve	CDB-F20-04b		CDB-F20-04b

7.1 Overview

The hydraulic system mainly includes oil pump composed of front and rear pumps, multi-way valve (bypass valve and multi-way valve mounted together), steering unit, high/low pressure oil pipe and joint, etc. Oil pump is a gear pump, mounted on the side face of transmission. When engine runs, it actuates the oil pump. It sucks out oil from oil tank and transmit it to multi-way valve. The safety valve inside the multi-way valve is used to maintain the oil pressure of oil circuit within the range of the specified value, while through the control over the valve stem, the passage of oil circuit inside the multi-way valve body is changed, to take the control over the cylinder. The oil through bypass valve to the steering unit is used to control the action of steering cylinder.

7.2 Oil Pump

Oil pump is composed of front and rear pumps. The front pump is the main pump, used for steering, lift, and tilt, while the rear pump is only used for lift and tilt.

The oil pump is a gear pump, mainly composed of driving gear, driven gear, and pump body, namely the oil pump includes two gears and some other parts. The driving gear and the driven gear are engaged. Speaking from the forklift trucks with power brake, the front pump is a duplex pump, while the small pumps in serial connection are specially applied to oil supply for power brake.

7.3 Multi-way Valve (Refer to Fig 7-1.)

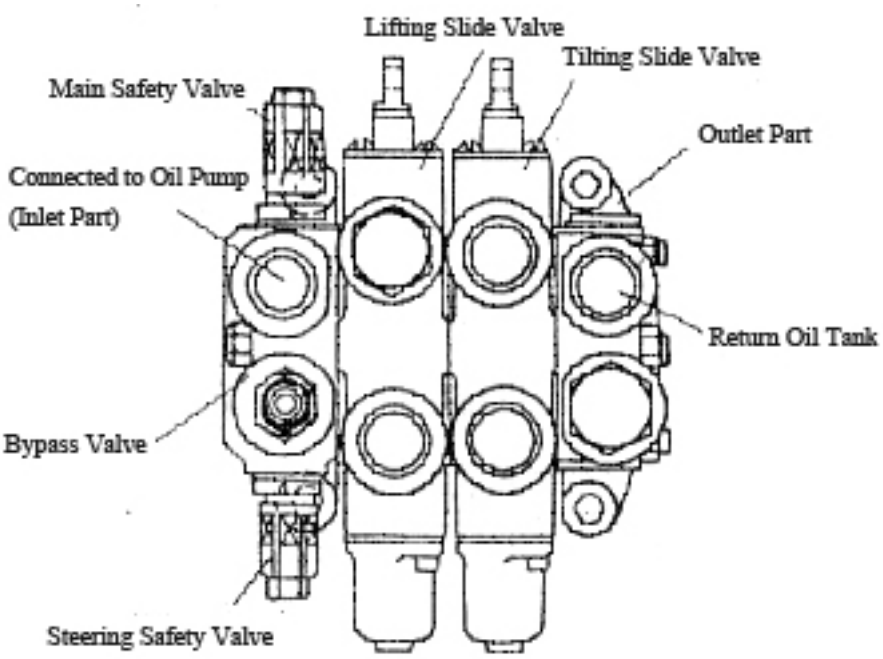


Fig 7-1 Multi-way Valve

Multi-way valve is in a cut type, and it is composed of three major parts including inlet (bypass valve mounted in the part of inlet), outlet, and slide valve. Three bolts are used to assemble these three parts together. Bypass valve (in the part of inlet) are mounted together with multi-way valve, for the structure to be compact and the pipeline to be simple.

A cylinder-shaped main safety valve is available in the part of inlet, used to adjust the oil pressure in oil circuit. Steering safety valve is also available, for adjusting the oil pressure in the power steering oil circuit. The limit identifications of the safety valves are marked using red scale lines.

Slide valve is used to control lift and tilt cylinders. It achieves the aim for controlling cylinder by changing oil flow rates through control over the lift and tilt valve stems.

A tilt auto-locking valve is mounted on the tilt slide valve, and the return oil from the cylinder shall return to oil tank through the part of outlet. Respective plate valves are all sealed up using O-rings, and at the same time a one-way valve is installed in the oil passage at the side of high pressure.

7.4 Operation of Multi-way Valve

(1)Middle Position: (Refer to Fig 7-2.)

The oil from the main pump returns to oil tank through the middle passage. At this point, both joints A and B of cylinder are under the closed status.

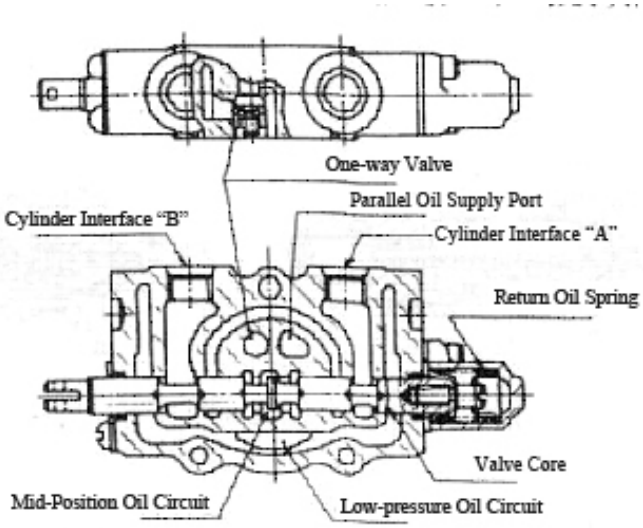


Fig 7-2 Middle Position

(2)Push-in Slide Valve: (Refer to Fig 7-3.):

At this point the middle passage is under the closed status (not through). The oil from the oil inlet port bursts through (load) the one-way valve and flows into the joint B of cylinder, and the return oil from the joint A of cylinder returns to oil tank through low-pressure passage. By virtue of the return spring, it is able to allow the slide valve to return to the middle position.

(3)Pull-out Slide Valve (Refer to Fig 7-4.):

At this point, the passage at the middle position is also under the closed status. The oil from the oil inlet port bursts through (load) the one-way valve, and flows into the joint A of cylinder, while the return oil from the joint B returns to oil tank through low-pressure passage. By virtue of the return spring, it is able to allow the slide valve to return to the middle position.

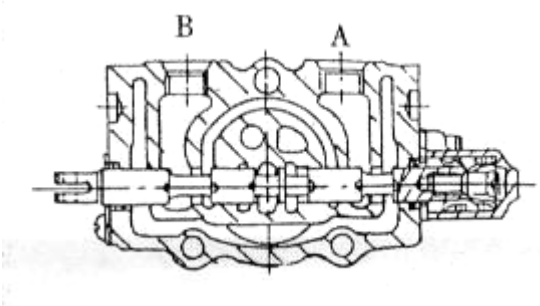


Fig 7-3 Push-in Slide Valve

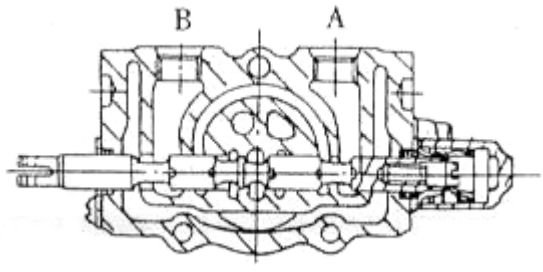


Fig 7-4 Pull-out Slide Valve

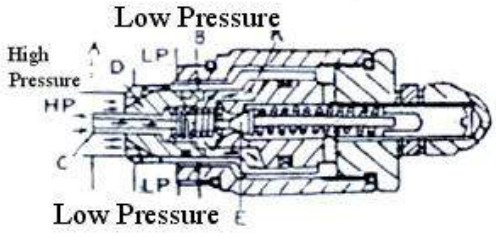
7.5 Work of Main Safety Valve

(1)The main safety valve is installed between the HP joint and the LP passage of the cylinder. The oil flowing through the valve core C acts on the two surface A and surface B of different diameters, and consequently the valve core K of the one-way valve and the valve core D of the main safety valve both firmly drop into the valve seat (Refer to Fig 7-5.).

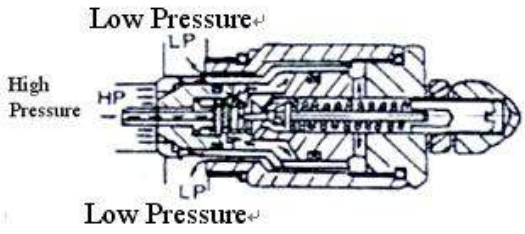
(2)When the oil pressure in HP joint of cylinder exceeds the set pressure of the spring force, at this point, the pilot valve core "E" is opened, the oil flows into the hole through around the valve core, and then flows into the LP passage (Refer to Fig 7-6).

(3)When the pilot valve core E is opened, the pressure after the valve core C drops, and therefore, the valve core C will move rightwards, and be seated on the pilot valve core E. As a consequence, the oil circuit b after the safety valve core D is cut off, and accordingly its internal pressure drops as well (Refer to Fig 7-7).

(4)Compared with the joint "HP of cylinder, the internal pressure turns to be imbalanced with it, and as a result, the safety valve core D is opened, thus the oil at the HP side flows directly into the low-pressure passage "LP" (Refer to Fig 7-8.).



ig 7-5 Fig 7-6



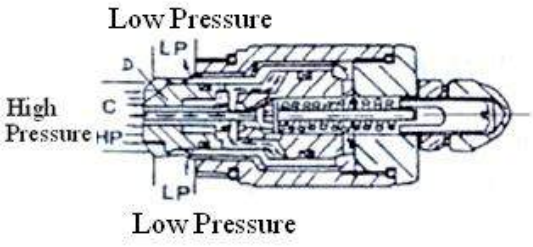


Fig 7-7

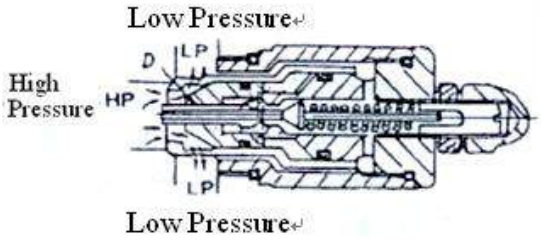


Fig 7-8

7.6 Work of Tilt Auto-locking Valve

The tilt auto-locking valve is used to prevent the shake of mast (arisen from the possibly generated internal negative pressure inside the tilt cylinder), and at the same time also to avoid the danger for mast to be tilted arising from misoperation (bump into the tipping control lever), when engine is flamed out. In conventional structure, even if the engine wants to stop rotation, the mast will also tip forward due to bump into tilt operating lever. However, after this new-type of tilt self-locking part is used, under the abovementioned circumstances, the mast will not tip forward, and it will not tip forward, even if the tilt operating lever is forcibly pushed. Refer to Fig 7-9 for the structure of the tilt auto-locking valve. In the drawing, the joint A is connected to the front side of the tilt cylinder, while the joint B is connected to the rear side of the tilt cylinder. When tilt operating lever is pulled, (the slide valve pulled out), the oil from the oil pump flows into the joint A, while the oil from the joint B returns to the oil tank, and accordingly the mast will tip backward. When tilt operating lever is pushed (slide valve pushed in), the oil from the oil pump flows into the joint B, and the auto-locking valve in the tilt slide valve is enabled, by virtue of HP oil, for the joint A to be connected to LP, while the mast will tip forward accordingly. However, in the case when engine is turned off, as there is no HP oil to enable the auto-locking valve, the joint A will not be connected to LP, and the mast will not tip forward, while negative pressure will not be generated inside the tilt cylinder.

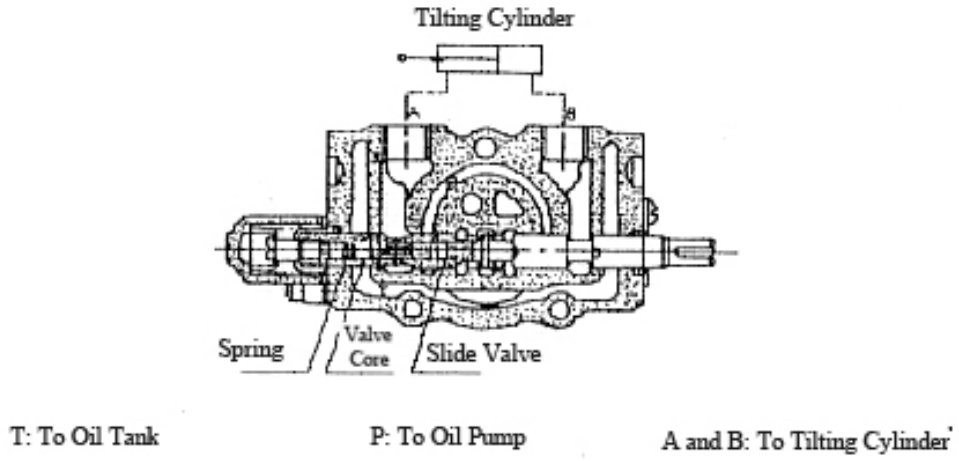


Fig 7-9 Tilt Self-locking Valve

7.7 Control Device of Multi-way Valve (Refer to Fig 7-10.)

Respective slide valves of multi-way valve are controlled by different control handles that are mounted on one same shaft. The shaft is mounted on the bracket on the front instrument bracket, and different control levers on it are passed onto the respective slide valves of the multi-way valve through connecting rod.

7.8 Oil Tank

The hydraulic oil tank is installed on the right side of the truck frame, and the suction oil filters for the front and rear oil pumps, the oil filler cap with oil leveler, and the brake return oil pipe used during power brake are mounted on the oil tank cover. Refer to Fig 7-11.

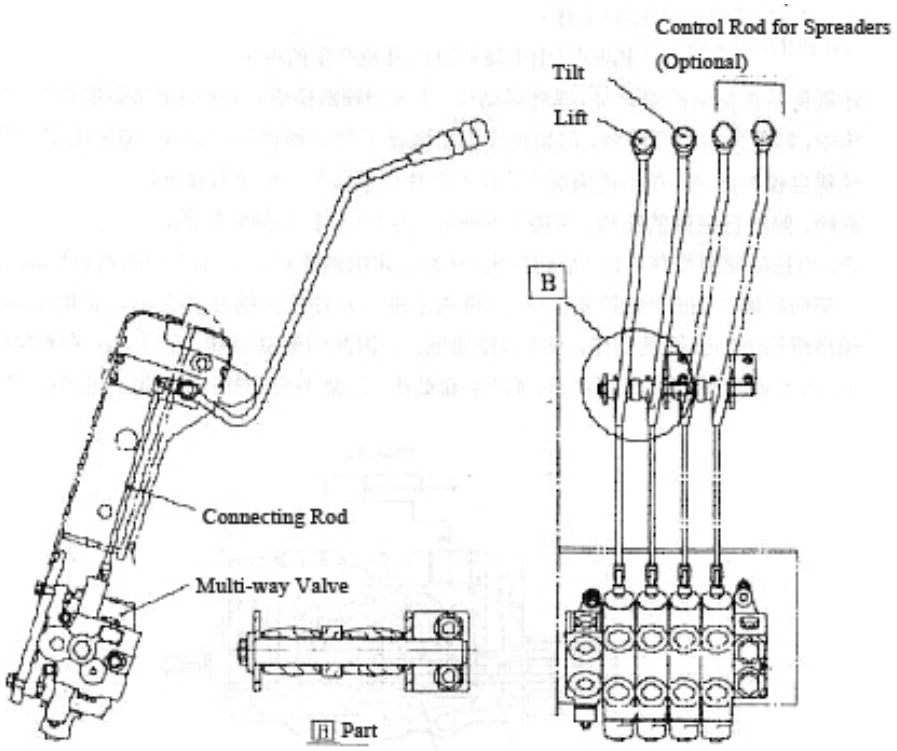


Fig 7-10 Multi-way Valve Control Device

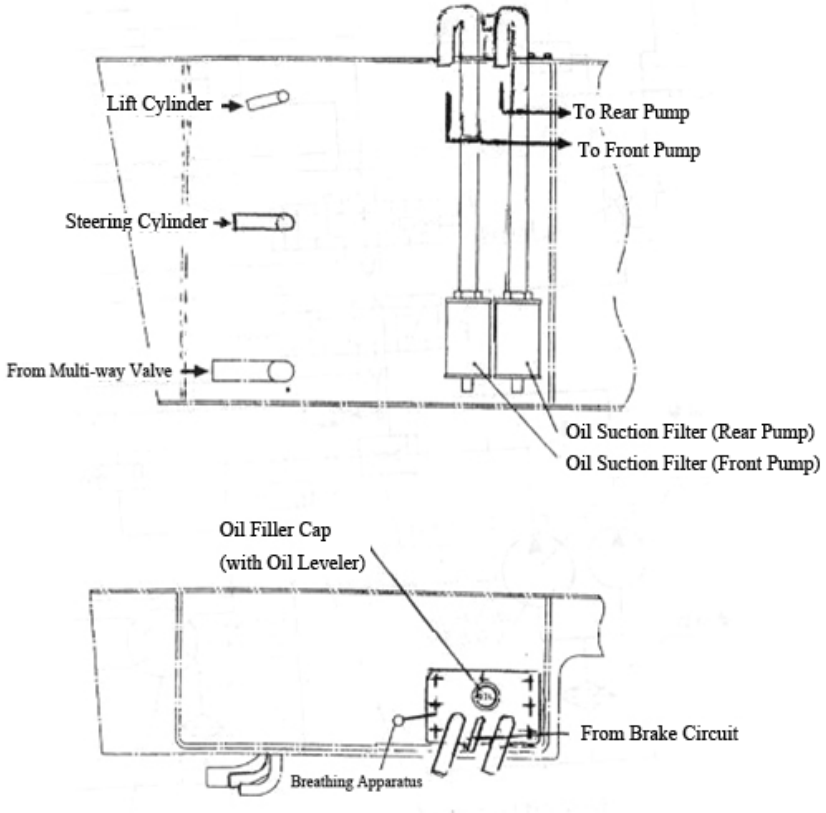


Fig 7-11 Oil Tank

7.9 Oil Circuit of Hydraulic System (Main Oil Circuit):

Refer to Fig 7-12 for principle of hydraulic system.

Refer to Fig 7-13 for oil circuit diagram of hydraulic system for 5-10t forklift truck.

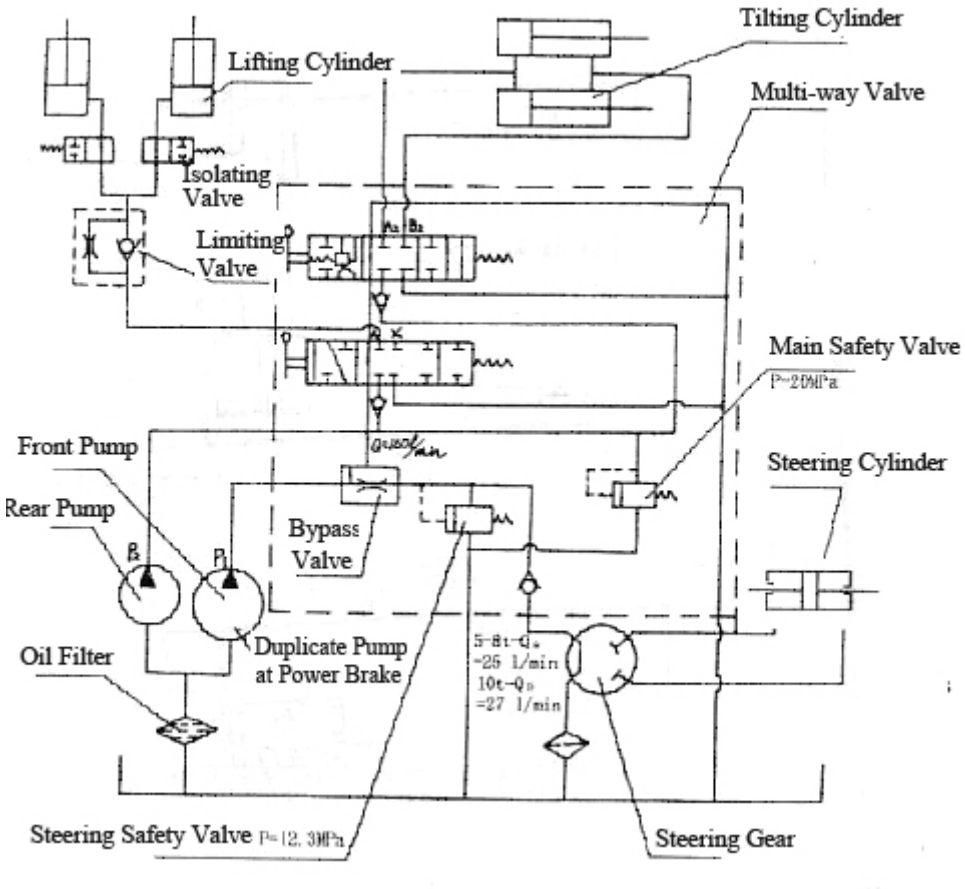


Fig 7-12 Schematic Drawing of Hydraulic System

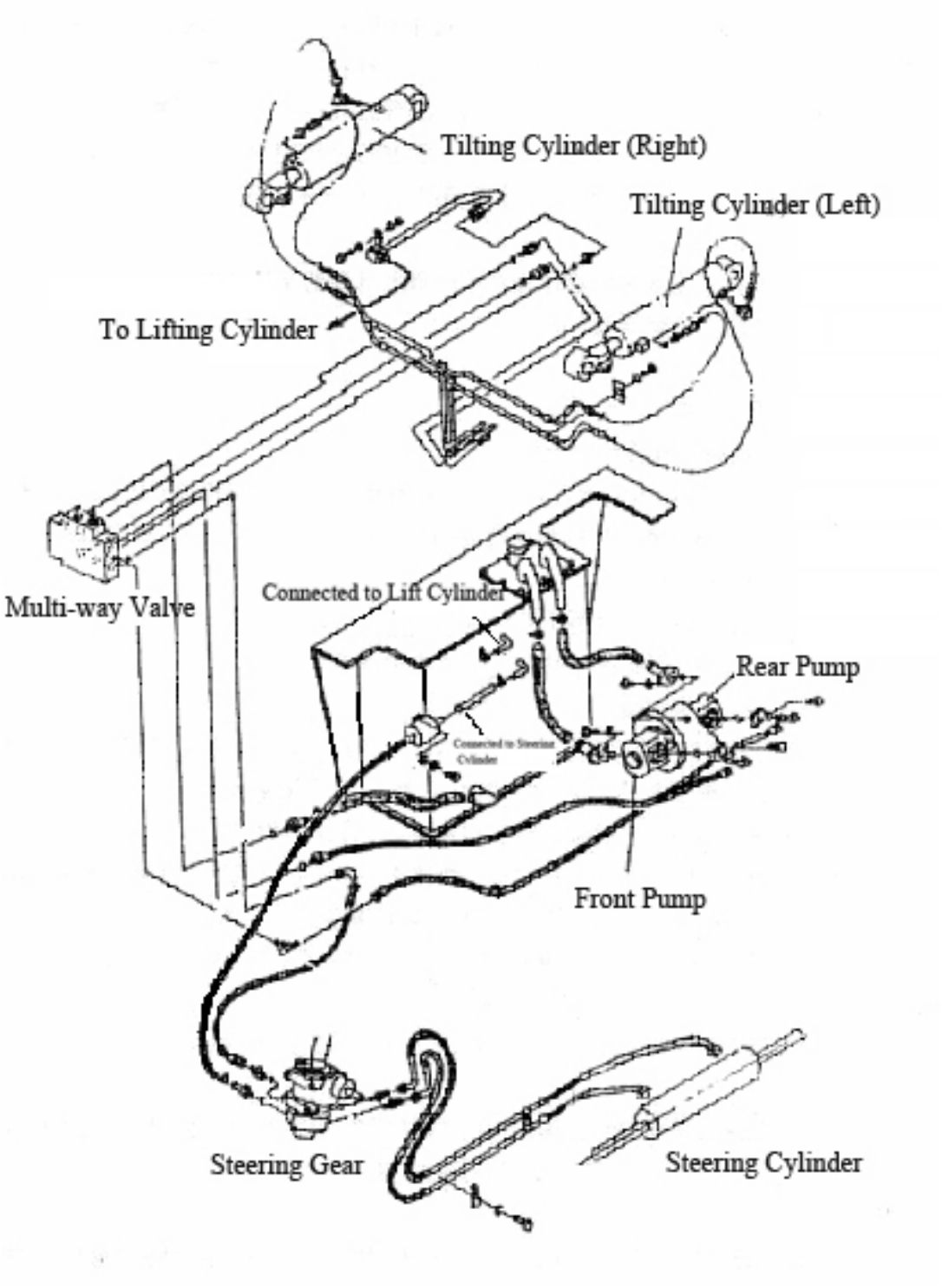


Fig 7-13 Drawing of Oil Circuit for Hydraulic System (5-10t)

The main oil circuit for hydraulic system turns to be complicated as double pump and steering oil circuit are applied. O-ring is used for the joint of oil pipe, for sealing, typical of a very satisfactory sealing property, to ensure the oil sealing.

The hydraulic oil drained from the rear pump is directly sent to multi-way valve, while the hydraulic oil drained from the front pump (the main pump) is divided into two circuits through bypass valve, namely for the steering and cargo loading-unloading tasks.

The abovementioned hydraulic oil used for cargo loading-unloading work flows into the multi-way valve and is added together with the return oil drained from the rear pump to be supplied for the purposes of cargo lift and tilt. When multi-way valve is under the status of middle position, these hydraulic oils return to oil tank through multi-way valve.

When lift control lever is pulled, the oil from the multi-way valve reaches the lower part of the lift cylinder piston through limiting valve, and drives the piston rod. When lift control lever is pushed, the oil circuits between the lower part of the lift cylinder position and the oil tank are connected. Due to the deadweights of piston rod, fork carriage, and fork, etc, the piston begins to drop, and in this case, the speed of return oil flowing back through multi-way valve is adjusted by limiting valve.

When tilt lever is operated, the hydraulic oil from the main pump reaches the certain side of the tilt cylinder piston and drives the piston to act, while the oil on the other side will be pushed out by piston, and return to oil tank through multi-way valve.

7.10 Maintenance

7.10.1 Disassembly of Multi-way Valve

Disassemble the multi-way valve from the forklift truck and clean its external part.

(1)Remove the connecting blots, for respective plates of multi-way valve to be taken apart, but don't lose the springs on the one-way valve and the bonding face.

(2)Demount the screw on one side of the slide valve head and the bolt with hexagonal slot on the cover side, and detach the slide valve including rubber cup, o-ring, and sealing plate altogether from the valve body.

(3)Put the slide valve on the bench vice, loosen off the connecting bolt for the cover, and then detach the spring and the spring seat. Also demount the spring and the valve core inside the tilt auto-locking valve, from the tilt slide valve mounted with tilt auto-locking valve.

7.10.2 Reassembly of Multi-way Valve

Clean all the detached parts using mineral oil, and examine whether or not burr or score is present, to be replaced if required. The valve body and the slide valve, as well as the slide valve and the valve core shall be properly wrapped up after assembly, to be wholly replaced if required.

(1)Clamp the slide valve using bench vice, and then fit in the valve core and the spring. Pay attention to the direction of valve core.

(2)Fit in the o-ring, rubber cup, sealing plate, and spring seat, as well as spring and spring seat, to be mounted in this sequence into the back end of the slide valve. Tighten the connecting bolts at a 25～32N·m torque, after they and the cover are properly assembled.

(3)Insert the slide valve assembly (one-plate valve) properly assembled into the valve body and fit in the cover, to be connected using the bolts with hexagonal slot (the tightening torque for the bolts as 9～11N·m).

(4)Fix the o-ring and the rubber cut onto the head of the slide valve, and screw down the sealing plate using bolts, at a tightening torque of 4.6～5.8N·m.

(5)Fit in the one-way valve, spring, and o-ring into each one-plate valve, after being assembled, and then use three connecting bolts to tighten it up according to the specified torques (103N.m for one bolt, and 66N.m for the other).

7.10.3 Notices

The pressure for respective safety valves in multi-way valve has already been properly adjusted before factory delivery of the forklift truck, and user shall not make adjustment at discretion during use, to avoid damage of hydraulic system and hydraulic components due to too high pressure adjustment. Adjust the pressure for respective safety valves correctly according to the requirements of the manual after maintenance.

8. Lift Cylinder and Tilt Cylinder

Refer to Table 8-1 for main technical parameters.

Table 8-1

Item \ Forklift Truck Tonnage			5-7t	8t	10t
Lift Cylinder	Type		Single-Action Piston Type		
	Inner Diameter of Cylinder	mm	Φ80	Φ90	Φ100
	Outer Diameter of Piston Rod		Φ60	Φ70	
	Cylinder Stroke		1495		
Tilt Cylinder	Type		Double-Action Piston Type		
	Inner Diameter of Cylinder	mm	Φ115		
	Outer Diameter of Piston Rod		Φ50		
	Cylinder Stroke(6°/12°)		227	242	

8.1 Lift Cylinder

Two single-action lift cylinders are respectively fixed in the rear area of the both sides of the outer mast. The bottom of cylinder is fixed on the bracket for the cylinder on the outer mast, while the top part of the cylinder, or the tail part of the piston rod is connected with walking beam using bolts. The strokes for the two lift cylinders shall be consistently adjusted, for the two cylinders to be synchronous. They shall be adjusted through bolt if not synchronous (Refer to Fig 8-1).

The lift cylinder is mainly comprised of cylinder block, piston, piston rod, and cylinder head. There is one oil inlet port in the lower part of the cylinder block, and the HP oil enters therefrom. In the upper part of the cylinder block, there is an oil outlet port under the Yx seal ring of the piston, and the LP oil is drained therefrom (The oil outlet port is connected with oil return pipe.).

The piston and the piston rod are fixed together using slot nut, cotter pin, and o-ring, while Yx seal ring, retainer ring, and support ring are mounted on the external circumference of the piston. For the action of HP oil, the piston moves upward along the internal surface of the cylinder block. Dust ring and steel-backed bearing are installed on the cylinder head that is screwed into the cylinder block depending on thread. The steel-backed bearing is used to support piston rod, while dust ring is to prevent the entry of dust into the cylinder. On the top of the cylinder, the tail part of the piston rod and the upper cross beam of the inner mast are fixed using bolts.

When lift control lever is pulled backwards, the HP oil is introduced into the cylinder through the oil inlet port of the lift cylinder and drives the piston rod and the walking beam, for the Fork to rise through chain. When the inner mast just begins to rise, the height from the ground to the position of Fork is called the free lifting height, and the height of mast does not change, within this range.

While the lift control lever moves forward, due to the deadweights of piston rod, Fork Carriage, cargo stop frame, and Fork, the piston is dropped, and drain the oil under the position out of the cylinder block. The speed of the oil drained from the cylinder block is controlled by the limiting valve (throttle valve), and the oil returns to oil tank through multi-way valve.

Refer to Fig 8-1 for the structure of lift cylinder for 5-8t forklift trucks. Refer to Fig 8-2 for the structure of lift cylinder for 10t forklift truck.

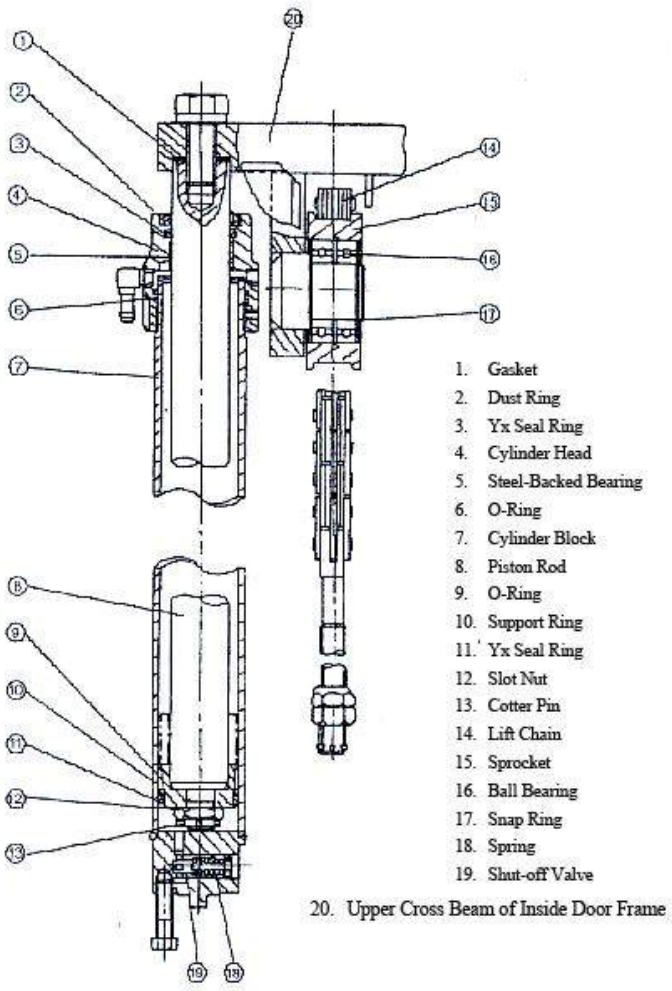


Fig 8-1 Lift Cylinder (5-8t Forklift Trucks)

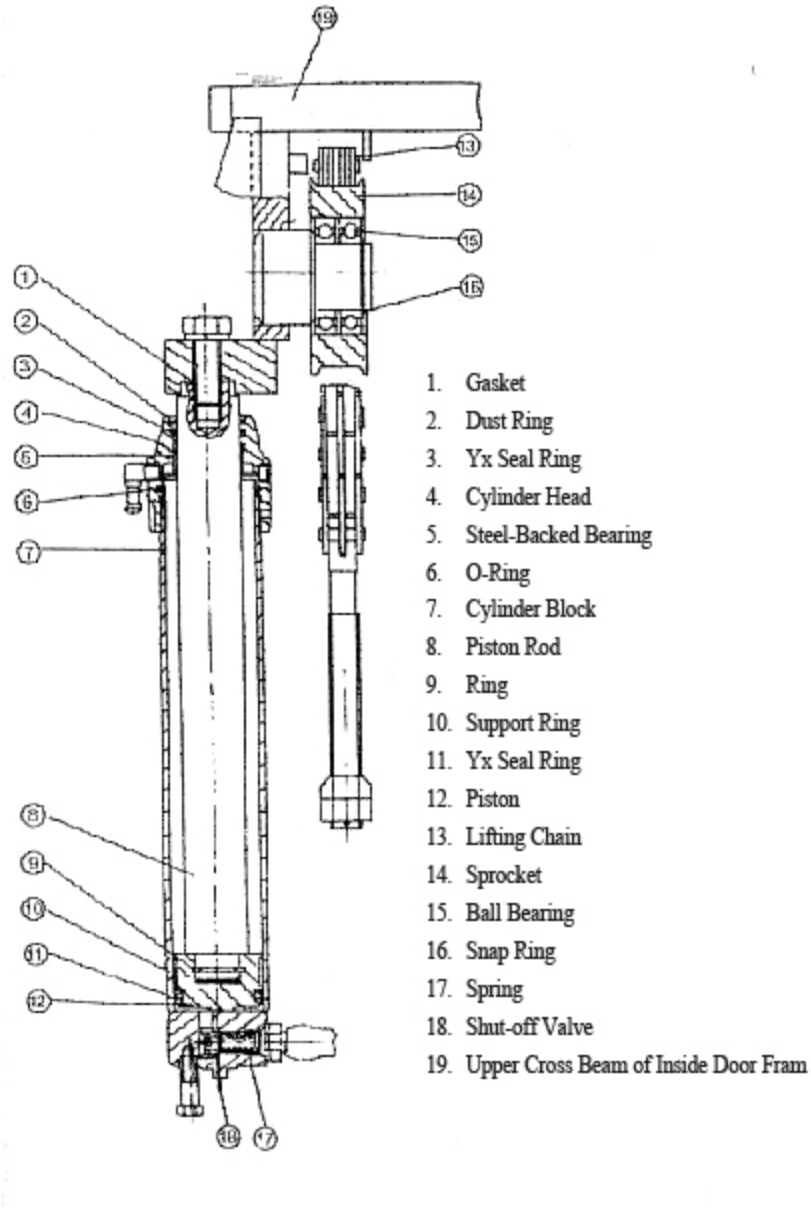
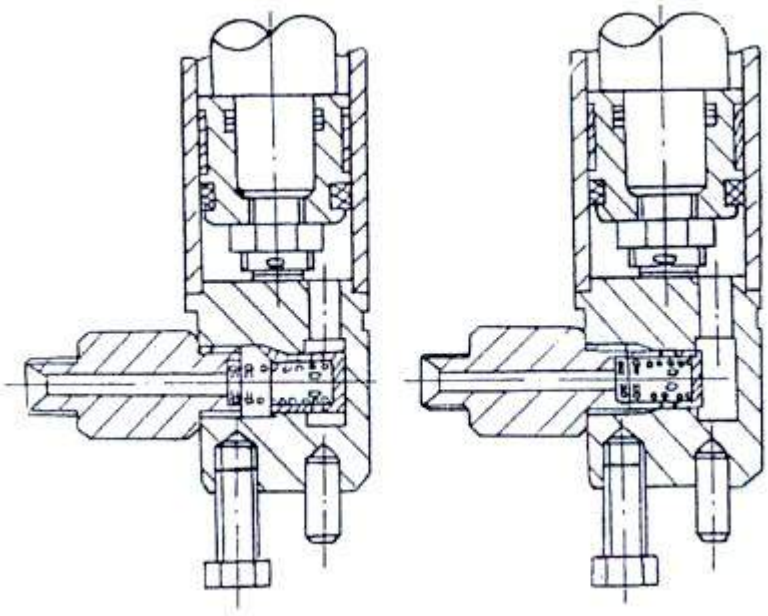


Fig 8-2 Lift Cylinder (10t Forklift Truck)

8.2 Isolating Valve

Isolating valve is installed on the bottom of the two lift cylinders (Refer to Fig 8-1 Sequence 19 or Fig 8-2 Sequence 18). When HP hose is suddenly cracked, the valve is able to prevent sharp drop of cargo. Refer to Fig 8-3 for the structure of isolating valve. The return oil from the lift cylinder passes through the isolating valve, and the oil holes around the slide valve allow the two cavities to give rise to pressure difference. When this pressure difference is smaller than the spring force, the slide valve is not actuated. If the HP hose is suddenly cracked, and only a small quantity of oil flows though the pores on the end face of slide valve, the fork will drop at a slow speed accordingly.



When Normal When Disconnected

Fig 8-3 Isolating Valve

8.3 Limiting Valve

The limiting valve (namely throttle valve) is mounted on the oil circuit between the multi-way valve and the HP oil port of the two lift cylinders, positioned close to the left lift cylinder (Refer to Fig 8-4.) Limiting valve is used to limit the dropping speed of fork when it is heavily loaded, and refer to Fig 8-5 for its structure. With regard to 8t and 10 t forklift trucks, their structures are basically similar to those of the 5-7t forklift trucks, as indicated in Fig 8-5 Sequence 3, while speaking from the 8t forklift truck, it has a tapered spiral spring, while 10t forklift truck is availed with a disc spring.

The limiting valve also plays the function as a safety device, in addition to control over the cargo dropping speed, namely for certain factor, the rubber hose between the multi-way valve and the lift cylinder is damaged, at this point, the limiting valve plays the part as a safety device (preventing danger arising from sharp drop of cargo).

The work of limiting valve is described as follows:

Refer to Fig 8-5. When fork rises, the HP oil from the multi-way valve flows into the cavity “A”, and drives the valve sleeve to move leftwards, thus to turn on the opening “G”, for the HP oil to flow

along two routes (A-B-G-D-E and A-B-C-D-E), with both of these two circuits of HP oil flowing into the lift cylinder. In this case, the flow rate of oil is not adjusted and limited. When fork begins to drop, the return oil drained from inside the lift cylinder enters into the cavity "E" and drives the valve sleeve to move rightwards, until the valve sleeve gets into contact with the joint, namely the opening "G" is closed. Accordingly the return oil must pass the throttle plate to flow back to oil tank through E, D, H, C, B, and A. if the amount of return oil drained from inside the lift cylinder is abruptly increased, the pressure in cavity "F" goes up, and drives the valve core (Fig 8-5 Sequence 5) to overcome the spring force and move rightwards, for the opening "H" to be narrowed. Consequently, the oil flow into the cavity "C" from the cavity "D" is reduced, namely the dropping speed of fork is limited (slowed down).

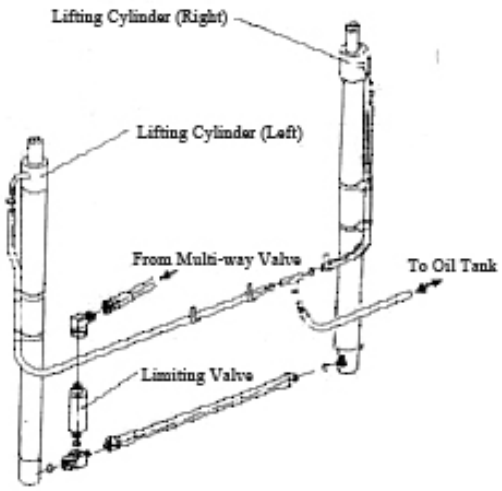
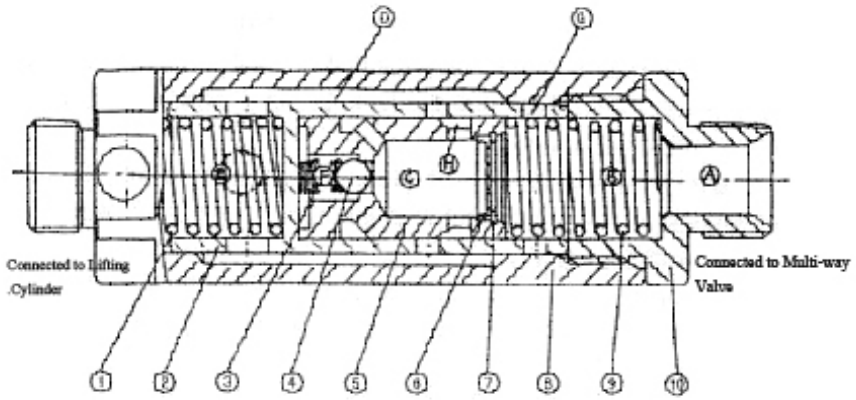


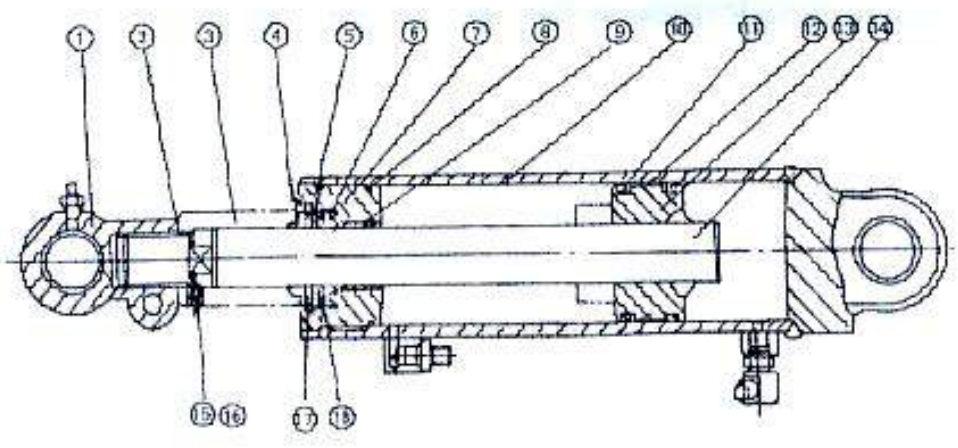
Fig 8-4 Assembling Position for Limiting Valve



1. Spring
2. Valve Sleeve
3. Spring
4. Nylon Ball
5. Valve Core
6. Throttle Plate
7. Retainer Ring
8. Valve Body
9. Spring
10. Joint

Fig 8-5 Limiting Valve (5-7t Forklift Trucks)

8.4 Tilting Cylinder



1. Lug Ring 2. Gasket 3. Adjusting Shaft Sleeve 4. Dust Ring
5. Retainer ring 6. Yx Seal Ring 7. Guide Sleeve (Cylinder Head) 8. O-Ring
9. Steel-backed Bearing 10. Cylinder Block 11. Yx Seal Ring
12. Support Ring 13. Piston 14. Piston Rod 15. Plug
16. Screw 17. Retainer ring 18. Retainer Ring

Fig 8-6 Tilt Cylinder

Two double-action tilt cylinders are installed on the two sides of mast. The end of piston rod in the front part of tilt cylinder is connected with mast, and the cylinder bottom at the rear end of tilt cylinder is connected with frame using pins. The tilt cylinder assembly is mainly composed of cylinder block, guide sleeve, piston, and piston rod.

Piston is welded onto the piston rod, and 2 Yx seal rings and one support ring are fitted on the surface of external circumference of the piston. The piston moves inside the cylinder block, under the effect of hydraulic oil pressure.

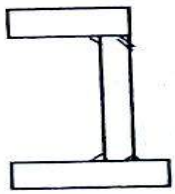
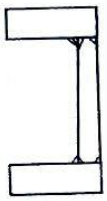
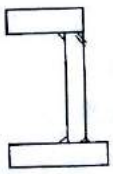
A steel-backed bearing is pressed and fitted in the inner hole of the guide sleeve (cylinder head), and a Yx seal ring and a dust ring are additionally mounted, used to prevent oil leak (between piston rod and guide sleeve and the dust. One o-ring is installed on the surface of the external circumference of the guide sleeve that is screwed into the cylinder block.

When tilt operating lever is pulled forward, the HP oil enters into the cylinder from the bottom of the cylinder, for the piston to move forward, and accordingly the mast will tip forward (reachable to 6°), and when tilt operating lever is pulled backward, the HP oil enters into the cylinder from the front guide sleeve, for the piston to move backward, and accordingly the mast will tip backward (reachable to 12°).

9. Lifting System

Refer to Table 9-1 for main technical parameters.

Table 9-1

Item \ Forklift Truck		5-7t	8t	10t
Type of Mast		Rolling Type, Welded Mast with Free Lift and 2-stage Telescopic Type		
Section Shape of Inner Mast				
Section Shape of Outer Mast				
Max Lifting Height (Standard Mast)		3000 ㎜		
Front-Back Tip Angle (Standard Status)		6°/12°		
Roller	Outer Diameter of Main Roller ㎜	Φ151.5	Φ183.5	
	Outer Diameter of Side Roller ㎜	Φ82		
	Outer Diameter of Side Roller (on Fork Carriage) ㎜	Φ102	Φ109.7	Φ119
Lift Chain (Leaf Chain)		LH2044，4×4 Pitch 31.75	LH2444，4×4 Pitch 38.1	LH2844，4×4 Pitch 44.5
Fork Lifting Mode		Hydraulic Type		
Mast Tipping Mode		Hydraulic Type		
Adjusting Mode for Fork Spacing		Manual		

9.1 Overview

Rolling type is applied to lifting system, and the basic type is a two-stage telescopic mast type. The inner mast is in a J-shaped section, while the C-shaped section is applied to outer masts for all the 5-8t forklift trucks, other than the outmast in a J-shaped section for 10t forklift truck.

9.2 Outer & Inner Mast

The mast assembly is in a two-stage telescopic type including free hoist, and it is composed of inner mast and outer mast, to be supported with bracket for mast, with the bracket for mast welded on the bottom part of the outer mast, extended to the axle housing, and connected together with axle housing, namely the deadweight of mast is supported by axle housing. There is also the bracket for tilt cylinder on the outer mast, and the front end of tilt cylinder (namely the end of piston rod) is connected with this bracket using pin shafts. The mast tilts under the action of tilt cylinder, for a forward tip of 6° and a backward tip of 12°.

9.3 Fork Carriage

Roller shaft is welded on the fork carriage, and the main roller and its snap ring rolling on the internal surface along the inner mast are mounted on the roller shaft, while the side rollers rolling on the inner side along the inner mast are prized onto the inner mast using bolts, and adjusted by adjusting shim. In order to prevent the sway of fork beam (support plate, or upper cross beam), two limit rollers are installed, and the limit rollers roll on the outer side face along the inner mast. The main roller bears the longitudinal load, and the main roller mounted above is exposed (some part), when the Fork rises to the maximum lifting height, while the limit rollers above and the side rollers below withstand the traverse load. Enough rigidity and strength have been taken into consideration about the design of mast assembly and fork carriage, while operating stability has been also considered at the same time.

Besides, the upper and lower cross beams of fork carriage are made of high-strength steel, and the fork carriage is made into an integrated structure, to ensure its durability. It complies with ISO standard (international standard).

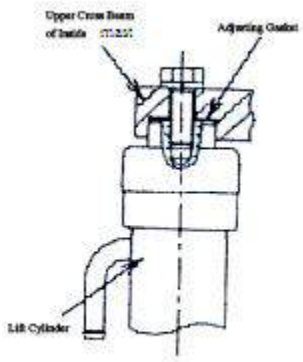


Fig 9-1

Two forks are loaded on the fork carriage. The forks are made of alloy steel, and are heat treated.

9.4 Adjustment of Lifting System

9.4.1 Gasket Adjustment for Lift Cylinder Head

When lift cylinder, inner mast or outer mast is disassembled and replaced, the stroke of lift cylinder shall be readjusted.

The adjusting method is described as follows:

(1)Load the head of piston rod not added with adjusting shim into the upper cross beam of inner mast.

(2)Slowly raise the mast to the maximum stroke of cylinder, and examine whether or not the two cylinders are synchronous.

(3)Add the adjusting shim between the head of piston rod for the cylinder that has firstly stopped movement and the upper cross beam of inner mast. Fig 9-1

Thickness of Adjusting Shim: 0.2 ㎜-0.5 ㎜

(4)Adjust the tensioning degree of the chain.

9.4.2 Height Adjustment for Fork Carriage

1) Park the truck on a level ground and keep the mast to be vertical.

2) Allow the bottom part of fork to contact the ground, and adjust the adjusting nut for the end joint in the upper part of chain for the exposure A of main roller in the lower part of fork carriage to be 1/4-1/3 that of the radius of the main roller.

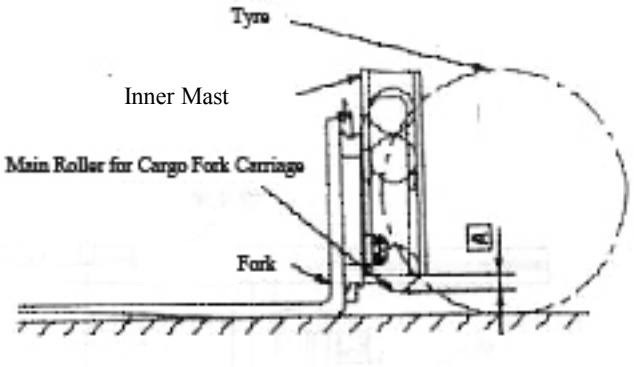


Fig 9-2

(3)Raise the fork to the maximum point, and confirm that the clearance B between the limit block of fork carriage and the limit block of inner mast is 5-10mm.

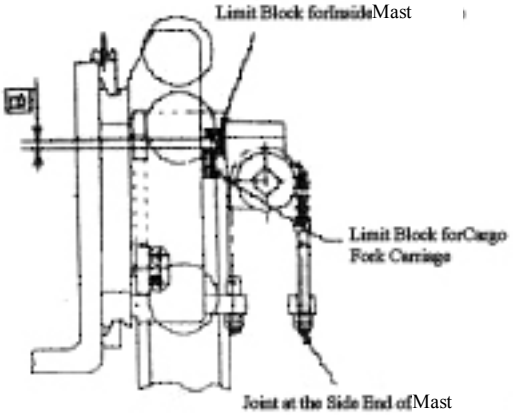


Fig 9-3

(4)Drop the Fork Carriage onto the ground and tilt backwards in place. Adjust the adjusting nut for the end joint in the upper part of chain, for the two chains to have the same tensioning degree.

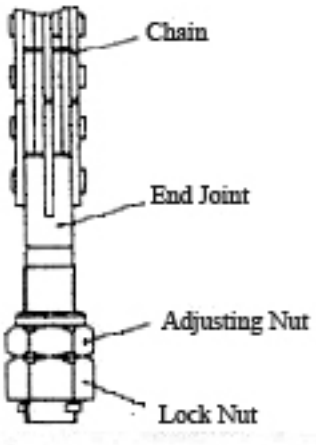


Fig 9-4

9.5 Mounting Positions of Rollers

There are 3 kinds of rollers for lifting system, i.e. main roller, side roller unit, and side roller, respectively mounted on the inside and outer masts as well as the fork carriage. The mounting layout for 5-10t rollers is largely identical but with minor differences, respectively represented in Fig 9-5, Fig 9-6, and Fig 9-7. The main roller bears the main load in the front and rear parts of forklift truck, nonadjustable generally, while the side roller bears the lateral load, generally able for adjustment of left-side and right-side clearances using unit of adjusting shims, for the inner mast and the fork carriage to move freely.

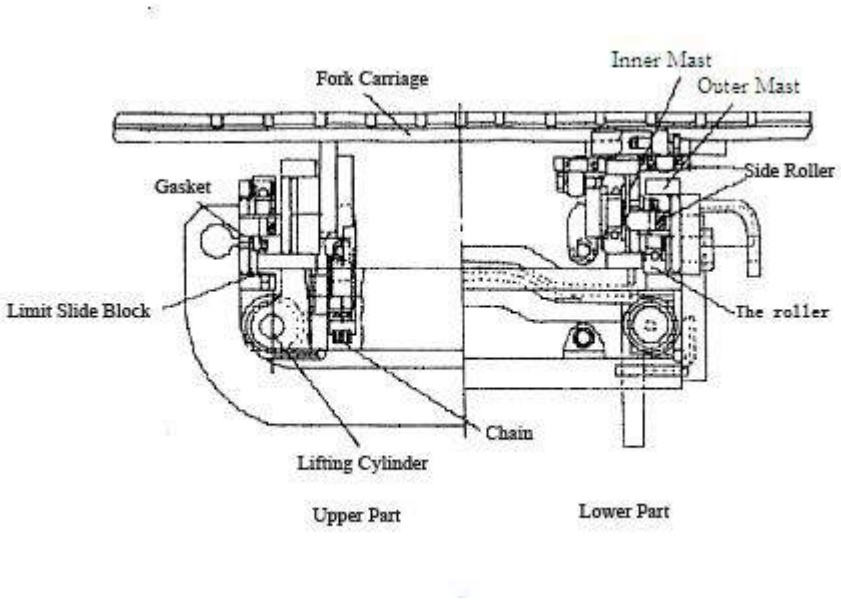


Fig 9-5 Roller Installation (5-7t Forklift Trucks)

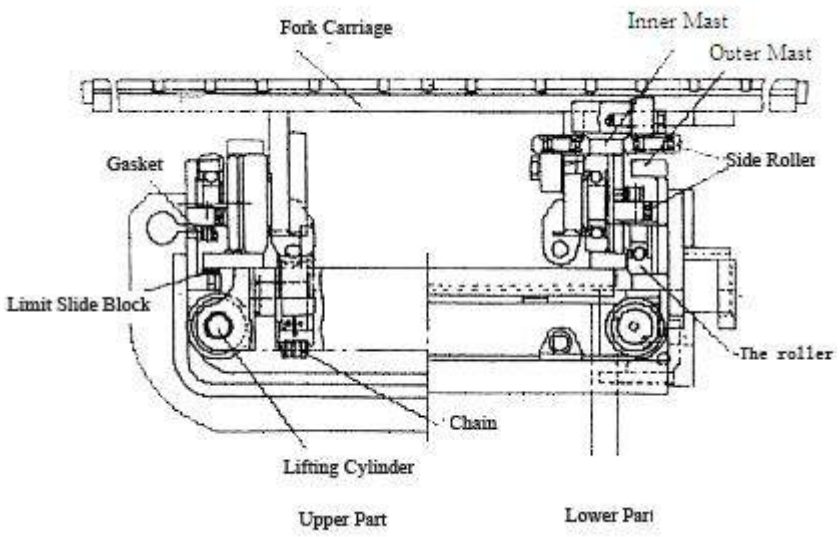


Fig 9-6 Roller Installation (8t Forklift Truck)

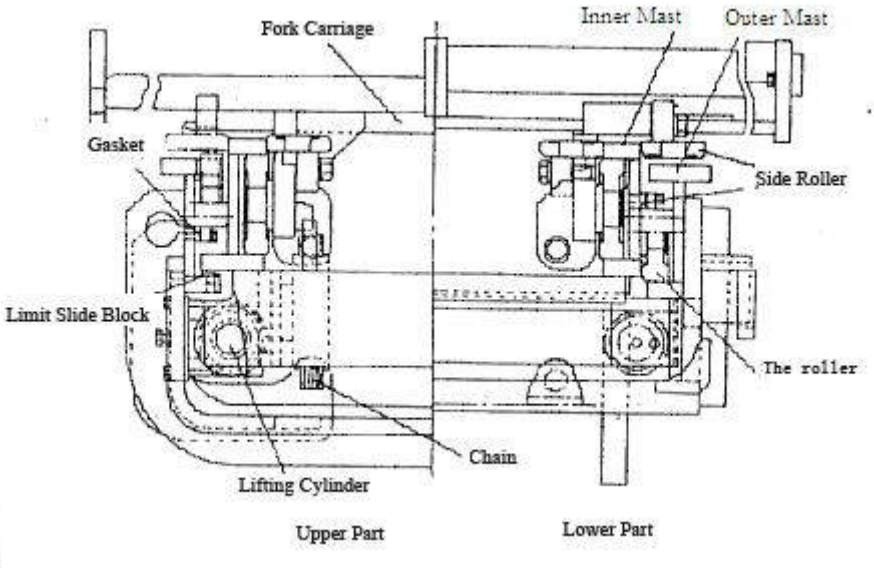


Fig 9-7 Roller Installation (10t Forklift Truck)